

WATER SUPPLIES DEPARTMENT
STANDARD SPECIFICATION EM-02-08
CHLORINE PLANT PROCESS CONTROL PANEL

This specification shall be read in conjunction with the following WSD Standard Specifications for chlorine plant:

- (a) EM-02-01 for Chlorine Plant - General and Design;
- (b) EM-02-02 for Chlorinator;
- (c) EM-02-03 for Chlorine Automatic Changeover Panel;
- (d) EM-02-04 for Chlorine Gas Detection System;
- (e) EM-02-06 for Chlorine Evaporator;
- (f) EM-02-07 for Weighing Scale for Chlorine Containers;
- (g) EM-02-09 for Chlorine Pressure Gauges; and
- (h) EM-02-10 for Chlorine Room Ventilation.

1. **DESIGN**

1.1 **General**

The Chlorine Plant Process Control Panel (CPPCP) shall interface with the Distribution Control System (DCS), Chlorine Plant Ventilation Control Panel (CPVCP) and Automatic Fire Alarm Panel (AFAP).

The panel shall be programmable logic controller (PLC) based with power supply equipment, touch screen panels and accessories to relay all the analogue, control, alarm and status signals from the chlorine process plant. It shall be compatible in appearance and size to the CPVCP as stipulated in EM-02-10 for Chlorine Room Ventilation, both of which shall be housed in the Chlorine Control Room.

1.2 **Monitoring and Control Functions**

1.2.1 Mimic diagram(s) shall be provided in the touch screen panel(s) for monitoring and control the following chlorine plant items.

- (a) Each Draw-off Unit
 - Net chlorine weight inside container (each weighing scale)
 - Chlorine container nearly empty alarm (each weighing scale)
 - Chlorine container empty alarm (each weighing scale)
 - Duty chlorine container in operation (each container)
 - Chlorine drum outlet disc ruptured alarm (each disc, if installed)
 - Chlorine header pressure low alarm (from chlorine pressure gauge at the evaporator inlet, i.e. P3 referred to WSD Standard Specification EM-02-09, where specified.)
 - Duty and standby supply pressure low alarm (from changeover panel)
 - Auto/ Shut-off/ Manual/ All Duty operation mode (from changeover panel)
 - Open/close status of duty and standby motorised valves (from changeover panel)

- Chlorine container changed alarm (from changeover panel and reset after empty container replaced)
 - Changeover valve emergency shut-off protection out indication
- (b) Each Evaporator (where specified)
- Evaporator in service
 - Water bath heater On/Off status
 - Evaporator loss of power supply alarm
 - Water bath level high alarm
 - Water bath level low alarm
 - Water bath temperature high alarm
 - Water bath temperature low alarm
 - Water bath cathodic protection current
 - PRV pressure high alarm (from chlorine pressure gauge between PRV and vacuum regulator-check unit, i.e. P5 referred to WSD Standard Specification EM-02-09)
 - PRV pressure low alarm (from chlorine pressure gauge between PRV and vacuum regulator-check unit, i.e. P5 referred to WSD Standard Specification EM-02-09)
 - Evaporator gas outlet open/shut-off status (from vacuum regulator-check unit)
 - Vacuum regulator-check unit temperature low alarm
 - Evaporator liquid inlet disc ruptured alarm
 - Evaporator gas outlet disc ruptured alarm
- (c) Each Chlorinator
- Chlorinator On/Off status
 - Manual/Automatic control mode
 - Chlorine residual set point or dosing factor (from operator input via DCS or the controller for automatic dosing)
 - Chlorine dosing set point (in kg/hr, calculated from the controller for automatic dosing)
 - Chlorine actual dosing rate
 - Chlorinator dosing point residual chlorine (each dosing point)
 - Chlorinator vacuum failed alarm (from low vacuum switch)
 - Chlorinator gas supply failed alarm (from high vacuum switch)
 - Chlorinator water supply failed alarm (from flow switch)
 - Ejector water pressure high alarm
 - Ejector water pressure low alarm
- (d) Each Chlorinator Booster Pumpset (where specified)
- Duty water pump in operation
 - Chlorine water supply pump failed alarm
 - Pump suction pressure low alarm
 - Motor tripped alarm

1.2.2 Indicating lamps shall be provided for the following system monitoring functions :-

- (a) Communication link to DCS healthy
- (b) DC power supply on
- (c) AC power supply on

1.2.3 Control functions

Description	Control Requirements
On/off control for booster pumps	- Via touch screen at CPPCP - Via DCS terminal at Main Control Room
Duty select for booster pumps	
Changeover valve emergency shut-off protection "In/Out" selection	- Via a key operated selector switch at CPPCP
Power supply "DC/Auto/AC" selection	- Via a selector switch at CPPCP

When the changeover valve emergency shut-off protection selector switch is set to the "In" position, the changeover valves of all the chlorine draw-off units shall be shut off on detection of a chlorine emergency alarm from the CPVCP. When the switch is set to the "Out" position, the protection out alarm shall be initiated. Hardwired logic shall be used for this protection function.

2. **CONSTRUCTION**

The CPPCP shall comply with WSD Standard Specification E-11-03. It shall have a degree of protection of IP 54 to IEC 60529 and be provided with a panel heater and associated wiring.

2.1 **The PLC Equipment**

The PLC modules of the CPPCP shall comply with WSD Standard Specification E-78-04. and the following particular requirements :

- (a) A PLC system including its touch screen panel shall only monitor up to 4 chlorine liquid draw-off units or 12 chlorine gas draw-off units. Additional PLC systems shall be provided when there are more process trains in the plant.
- (b) Each PLC system shall be designed in redundant arrangement with hot standby processors.
- (c) The PLC systems shall report the status of its input/output points to and accept control from a third party Distributed Control System (DCS) using OPC, Modbus or other approved Fieldbus protocol.

2.2 **Touch Screen Panels**

- (a) The touch screen panel shall be of industrial grade and shall conform to the following requirements:

- (i) Display: 19" color active matrix TFT
 - (ii) Resolution: 1280 x 1024 18-bit color graphics, 300 cd/m²
 - (iii) Backlight: 50,000 hr – field replaceable
 - (iv) Touch screen type: Analog resistive
 - (v) Communication ports: Ethernet, RS-232 and 2 x USB
 - (vi) Rating: IP54
- (b) A special area on the touch screen panel shall be maintained to display all active visual and audible alarms. This area shall not be covered by other data or windows i.e. always on top. When an alarm is detected, it shall be appended to the alarm queue and trigger the audible alarm. The alarm shall be acknowledged by clicking a screen button. Upon acknowledgement, the acknowledged entry shall be removed from the alarm area to the historical event data area and mute the audible alarm if there is no other unaccepted alarm.

2.3 Power Supply Equipment

The power supply for the PLC system shall be 24V d.c.. It shall be obtained from both the station battery and a built-in rectifier in the CPPCP via blocking diodes when the power supply selector switch is set to the "Auto" position. Fuse links shall be provided in the panel for isolating the ac and dc power supplies to the CPPCP.

2.4 Cable Termination

Adequate cable terminals shall be provided for terminating the cables from the chlorine plant equipment to the CPPCP. Terminals shall also be provided for the following connections:

- (a) Hardwired connections to the booster pump starter panels at the Switchgear Room;
- (b) Hardwired connection to the automatic changeover panel;
- (c) Hardwired connections to the evaporator and chlorinator;
- (d) Hardwired connection to the adjacent CPVCP; and
- (e) Dual network connections to the DCS at the Main Control Room.

- End of this Specification -