

WATER SUPPLIES DEPARTMENT
STANDARD SPECIFICATION EM-02-01
CHLORINATION PLANT- GENERAL & DESIGN

1. **GENERAL**

This standard covers the general design of chlorination plant in Water Supplies Department.

2. **SYSTEM**

Two types of draw-off systems are adopted for the chlorination plant, namely the gas draw-off system and the liquid draw-off system. The type of draw-off system to be deployed will be specified in the Particular Specification.

2.1 Gas draw-off System

In a gas draw-off system, chlorine gas will be withdrawn from standard chlorine container of either 50-kg cylinder(s) or 1-tonne drum. The draw-off unit of the system shall comprise two sets of container(s) in either single / twin / five 50-kg cylinders in a bank, or single 1-tonne drum with auto-changeover and shut-off control for operation in turn. Where necessary, both sets of chlorine container(s) will be operated simultaneously to achieve a higher gas withdrawal rate. The schematic diagram for the chlorination plant with gas chlorine withdrawal is attached at Appendix I.

2.2 Liquid Draw-off System

In a liquid draw-off system, liquid chlorine will be withdrawn from standard 1-tonne drum. Evaporator will be deployed in the system to assist withdrawal of liquid chlorine from the chlorine drum. Liquid chlorine shall be withdrawn from one drum only.

Two types of feeding arrangement to the evaporator are deployed for the liquid draw-off system. They are indicated in the typical schematic diagrams for the chlorination plant attached at Appendix IIA (one draw-off unit feeding one evaporator) and at Appendix IIB (one draw-off unit feeding two evaporators).

In the arrangement for feeding one evaporator, one chlorine evaporator will be fed by one chlorine draw-off unit comprising two chlorine drums with auto-changeover and shut-off. Similarly, in the arrangement for feeding two evaporators, two evaporators will be fed by one common draw-off unit comprising two chlorine drums with auto-changeover and shut-off. The feeding arrangement shall be specified in the Particular Specification.

2.3 Scope of Equipment of Chlorination Plant

Unless otherwise specified in the Particular Specification, the complete chlorination plant shall comprise the union connecting to the cylinder / drum valve up to and including the final dosing point including the cylinder / drum weighing scale.

3. CHLORINE CYLINDER / DRUM CONNECTION

The piping arrangement for chlorine cylinders or drums in single or multiple connections are shown in Appendix III.

Flexible tubing shall be provided for connection between the container and the receiver header. The container end and the header end shall have an auxiliary valve and two line valves for isolation respectively.

4. CONTROL

4.1 Automatic Changeover Control

An automatic changeover device shall be provided for change over of the draw-off from the emptying duty container(s) to the standby container(s) upon detection of a low pressure (set at 100 kPa) from the duty container. The changeover shall be actuated electrically. The low pressure detector in the chlorine supply line provides a signal to the changeover control panel to effect the operation. The changeover shall take place only if sufficient pressure is detected at the standby container. Otherwise, the changeover shall be inhibited.

A manual changeover facility in the form of a 3-position selector switch which will enable selection among Unit 1 Duty / Off / Unit 2 Duty shall be provided for overriding the automatic system.

4.2 Automatic Control During a Chlorine Leak

Upon detection of a chlorine leak of 3 ppm or above, which can be initiated either manually by pressing the emergency push button installed at the strategic locations of the installation or automatically by chlorine detectors, the following control functions shall be activated automatically.

- (a) To sound the chlorine emergency alarm.
- (b) To shut down the ventilation fans.
- (c) To close the dampers of the ventilation ducts.
- (d) To close all air inlet louvers.
- (e) To operate the chlorine scrubbing system if provided.

- (f) To shut off the supply from the chlorine containers as described in Clause 4.3 below.
- (g) To trip the power supply for the evaporator heating (if applicable).

4.3 Shutdown Control

Upon receiving a chlorine leak signal of 3 ppm or above, automatic control shall be provided to shut off the chlorine supply from the duty container(s) and inhibit the changeover to the standby container(s), i.e. the changeover valves for both duty and standby containers shall be closed under this circumstance.

Where evaporators are involved for liquid draw-off of chlorine from drums, the chlorine supply shall be automatically shut off upon detection of a high pressure in the chlorine supply line due to the burst disc of the evaporator.

4.4 Automatic Proportional Control

Automatic proportional dosing control if required for the chlorination system shall be either one or a combination of the following means which will be specified in the Particular Specification :-

- (a) Flow proportional control shall be effected according to a 4-20mA signal from the flowmeter of the installation to a controller. The controller shall be mounted either on the front panel of the chlorinator, or at the chlorine control panel with the necessary output signal to the chlorinator for the control.

The controller shall have a proportional control function with an adjustable proportional band setting for controlling the dosing rate. The controller shall equip with a manual override facility and an indication of both input signal and control signal.

- (b) Direct residual control shall be achieved by a controller similar to that described in paragraph (a) above but with a three-term control P+I+D for receiving a 4-20mA signal from the residual analyzer. This signal shall be used for comparison with the set-point on the controller so as to produce the appropriate control output to the chlorinator.
- (c) Compound loop control if required shall be detailed in the Particular Specification.

5. EQUIPMENT CONSTRUCTION

Components of chlorine equipment shall be housed in an enclosure made of reinforced fibre plastic. The gas inlet and water piping shall be readily accessible for cleaning, inspection and maintenance without the need to disturb the adjacent parts.

Components shall be fully resistant to the prolonged corrosive attack of chlorine, inclusive of leakage in the installation. Metal parts normally in contact with chlorine shall be monel or Hastelloy C or equal. External metallic parts such as nameplates, bolts and nuts shall be made of stainless steel.

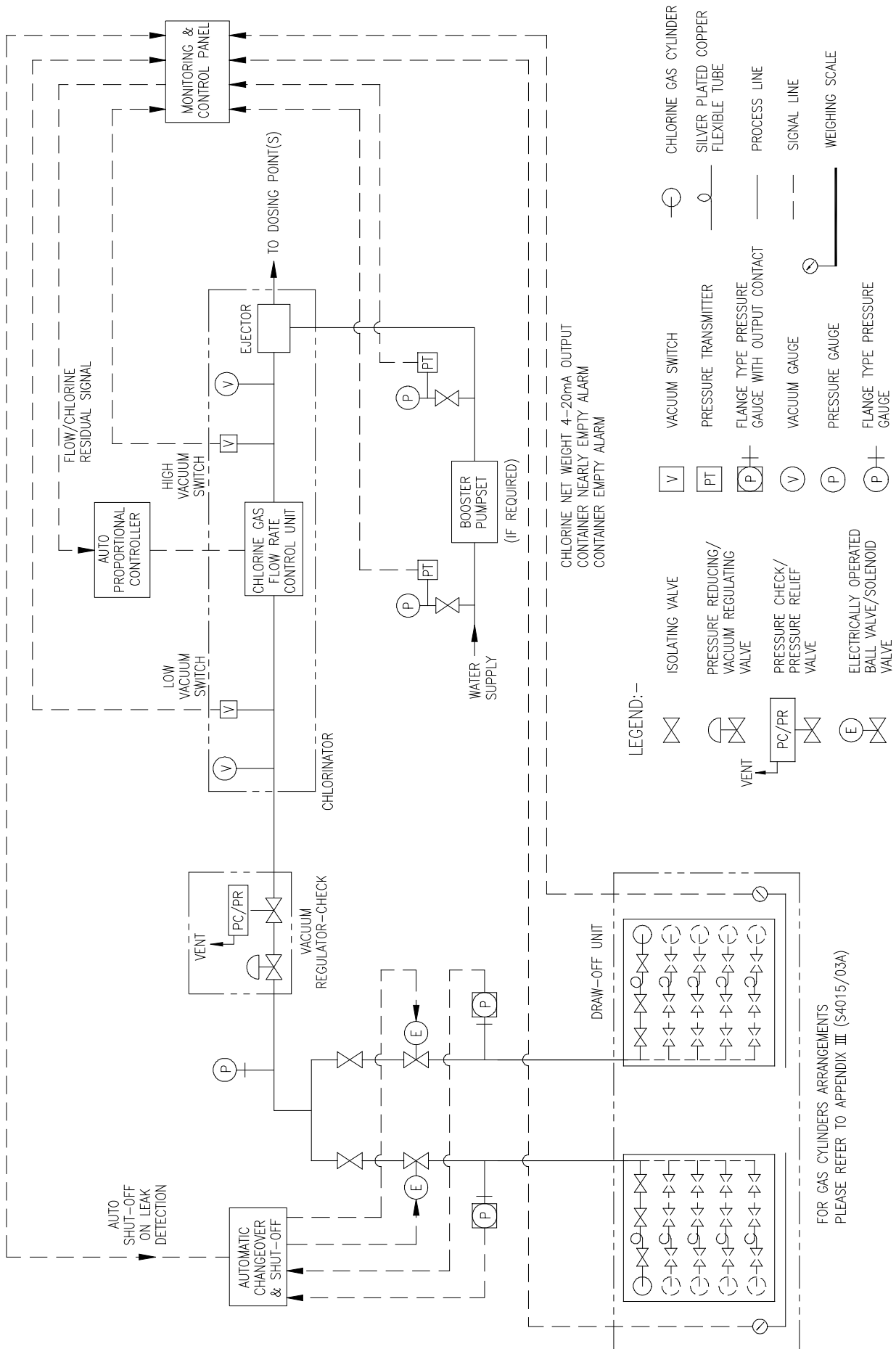
Parts not designed to be in contact with chlorine shall be totally enclosed, with the degree of protection of IP54 to IEC 60529.

6. ELECTRICAL EQUIPMENT

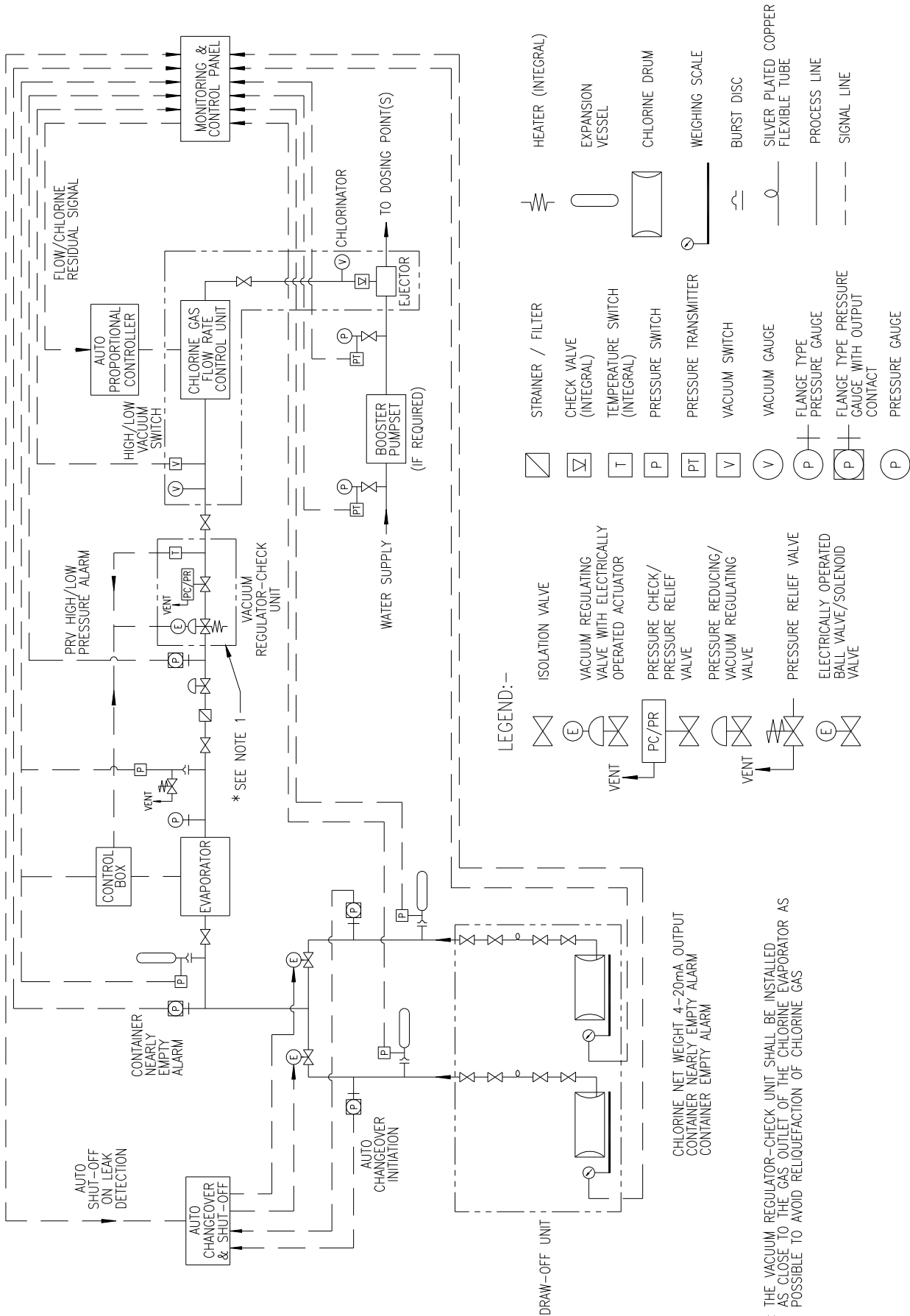
Power supply transformers, where fitted, shall be of totally encapsulated type. Indicating instruments which are surface mounted shall have a degree of protection of IP54 to IEC 60529.

Electrical equipment shall operate on 220V a.c. 50 Hz or 24V d.c. as specified. Switch contacts of instruments shall be of changeover type rated at 2A 220V a.c. 50 Hz and 3A 24V d.c.

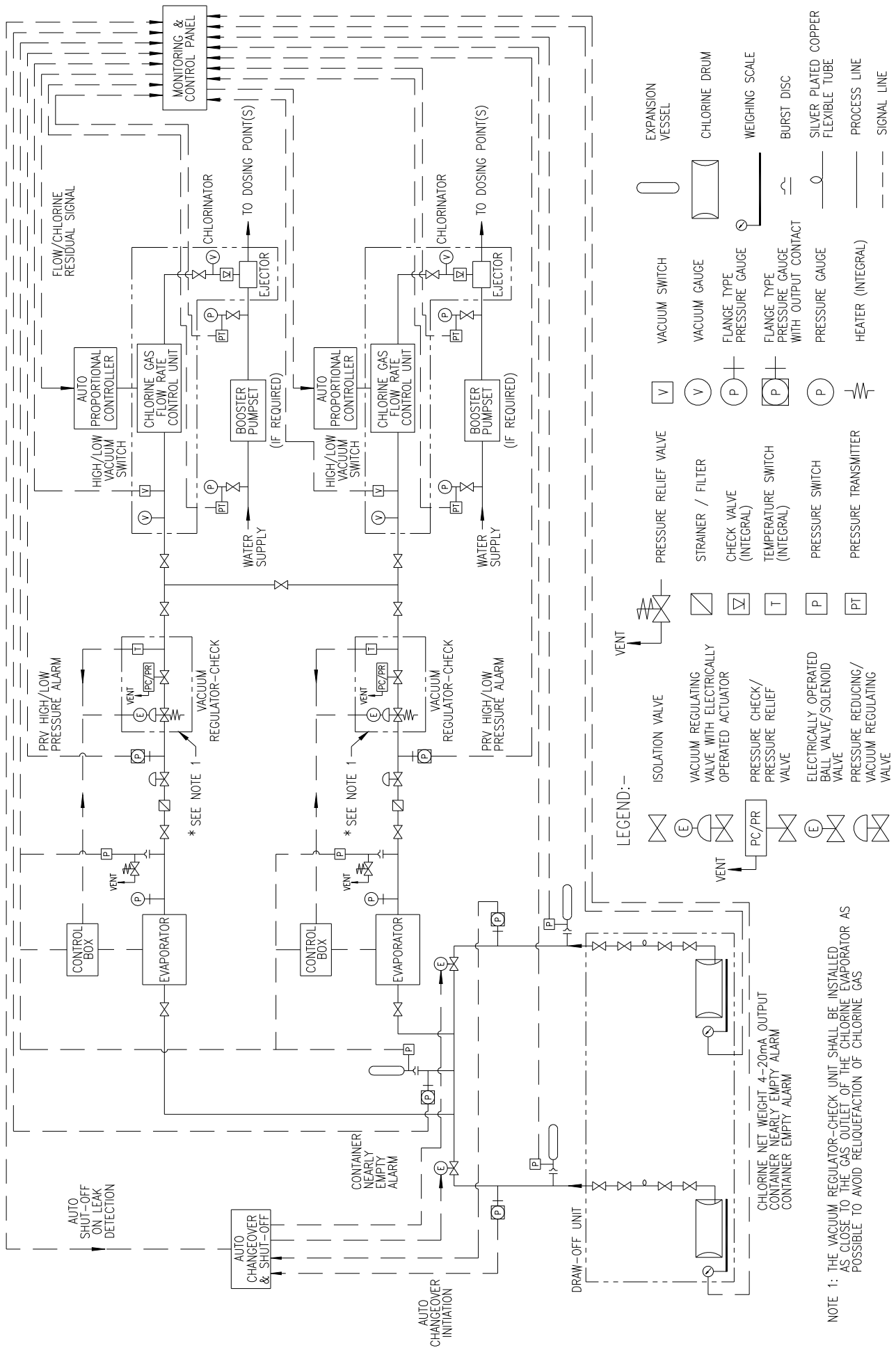
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SCHEMATIC DIAGRAM FOR CHLORINATION PLANT
(GAS DRAW-OFF)

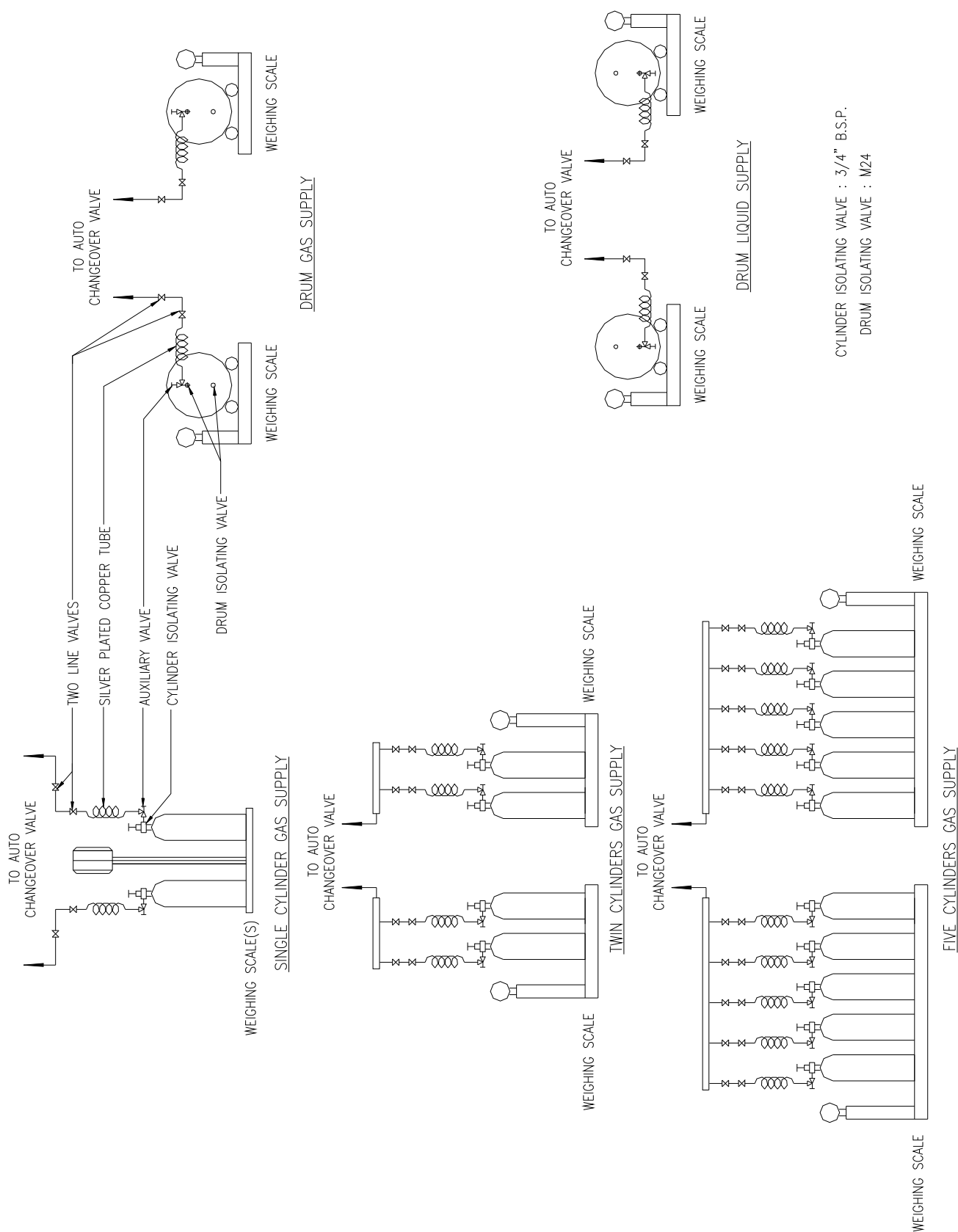


SCHMATIC DIAGRAM FOR CHLORINATION PLANT
(LIQUID DRAW-OFF UNIT FOR FEEDING ONE EVAPORATOR ARRANGEMENT)



NOTE 1: THE VACUUM REGULATOR-CHECK UNIT SHALL BE INSTALLED AS CLOSE TO THE GAS OUTLET OF THE CHLORINE EVAPORATOR AS POSSIBLE TO AVOID RELIQUEFACTION OF CHLORINE GAS

SCHEMATIC DIAGRAM FOR CHLORINATION PLANT
(LIQUID DRAW-OFF UNIT FOR FEEDING TWO EVAPORATORS ARRANGEMENT)



TYPICAL CONNECTION OF CHLORINE CONTAINER(S)