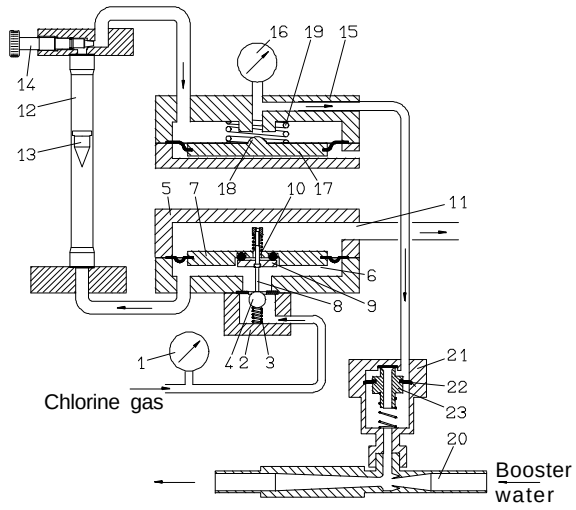
Indirect chlorination according to DIN 19606 has been a reliable and extremely safe method for decades. The process is precise and requires little maintenance. Besides, faulty operation can be excluded in most cases.

As opposed to direct chlorination, indirect chlorination stands out for its increased safety. The metering system does not work without an ejector (water-jet pump) producing a vacuum. It is this vacuum which activates the vacuum controller and allows chlorine gas to flow to the metering point. If there is no or unsufficient motive water the inlet valve at the metering unit is caused to close immediately.
The main safety aspect is the use of vacuum for transporting the chlorine from the metering unit to the metering point. In the case of possibly untight lines, chlorine gas cannot escape, only air may be sucked into the vacuum system. The highest possible safety is reached by connecting the metering unit directly to the chlorine cylinder.

The schematic diagram shows a typical arrangement of a full-vacuum metering system:



1 Pressure gauge
2 Inlet valve
3 Locking spring
4 Valve ball
5 Vacuum regulator
6 Vacuum chamber
7 Diaphragm disk in vacuum regulator
8 Valve stem
9 Valve seat for safety valve
10 Blowoff opening in diaphragm disk
11 Blowoff connection
12 Flow meter
13 Float element
14 Adjusting valve
15 Back-pressure regulator
16 Vacuum gauge
17 Diaphragm disk in back-pressure regulator
18 Regulating point at diaphragm disk
19 Pressure spring
20 Ejector
21 Ejector non-return valve
22 Diaphragm
23 Valve body

The metering system functions as described below. The numbers in brackets (....) refer to the schematic diagram.
If the system is out of operation, the chlorine gas expands under pressure to the ball (4) of the inlet valve (2). The locking spring (3) and the pressurized chlorine push the ball into the seat, thus locking the excess-pressure system. All other system parts are under atmospheric pressure.
By switching on the motive water supply, a vacuum is produced in the ejector (20), which applies a downward force to the diaphragm (22) in the non-return valve (21). It moves the valve body (23) downwards against the spring tension and opens the non-return valve. The vacuum is propagated through the back-pressure regulator (15) and the flow meter (12) to the vacuum regulator (5).
There the diaphragm disk (7) is drawn down due to the vacuum. The valve stem (8) connected with the diaphragm disk pushes the ball (4) downwards. It gets off the seat so that chlorine gas may enter the vacuum chamber (6). An equilibrium of forces is reached at the ball between vacuum and closing power. This equilibrium of forces is the so-called vacuum control.

The float element (13) in the flow meter (12) indicates the chlorine gas volume, and the flow rate can be set at the adjusting valve (14). The flow rate is determined by the gap width at the valve and the pressure drop above the valve. Fluctuating suction pressures of the ejector (due to e.g. varying motive water pressures) would thus cause fluctuating flow rates and inexact metering. Therefore the German standard DIN 19606 prescribes a device for "keeping the mass flow constant". This function is carried out by the vacuum regulator (15).
Depending on the power of the vacuum the diaphragm disk (17) is drawn up towards the pressure spring (19). The regulating point (18) of the diaphragm disk reduces the flow cross section if the vacuum is too strong and increases it if the vacuum is too weak. As a result the pressure remains constant at the adjusting valve (14) and thus also the chlorine gas flow rate.
The vacuum regulator (5) incorporates another function: the safety valve. If e.g. impurities don't allow the ball (4) to close firmly, a weak pressure is built up in the vacuum system. It pushes the diaphragm disk (7) in the vacuum regulator upwards until first the valve stem (8) rests against the housing. Then the diaphragm disk moves up without valve seat (9) so that the blowoff opening (10) in the diaphragm disk is released. The chlorine gas can be routed from the blowoff connection (11) to e.g. a chlorine sensor which sets off an alarm immediately.

By installing a motor-driven control valve in the line between flow meter and back-pressure regulator, the manually operated system is transformed into an automatic one.