

SUPPLEMENTAL/BID BULLETIN No. 2

2nd Public Bidding of the Site Development Works for the NDC Industrial Estate Project Brgy. Langkaan, Dasmariñas City, Cavite Project Reference No.: BAC19-01-004

This **Supplemental/Bid Bulletin No. 2** is being issued in relation to matters arising from queries of prospective bidders during the Pre-Bid Conference conducted on August 5, 2019 and during the Site Inspection conducted on August 10, 2019 and to modify and/or amend items in the Bid Documents. This shall form an integral part of the bidding documents.

Queries During the Pre-Bid Conference:

1. On the question whether or not a Joint Venture is allowed in the project, NDC BAC answered that it is allowed, and the eligibility requirements are stated in the Instructions to Bidders.
2. On the question whether or not subcontracting on specialty works is allowed, NDC BAC clarified that the Contractor is allowed to subcontract up to 100% for the following works and subcontractor needs to submit same eligibility requirements as the bidder and should be included in the bid documents:
 - a. Design and construction, supply/installation of electro-mechanical works, and testing and commissioning of Sewerage Treatment Plant (STP);
 - b. Construction and testing and commissioning of Deep Wells; and
 - c. Supply/installation and testing and commissioning of electro-mechanical works for deep well pump stations; and
 - d. Construction of generator house, and supply and installation, testing and commissioning of generator set

If the Contractor has the capability to do any or all of the above-listed subcontract works, it is not mandatory to obtain a subcontractor. The Contractor, however, should be able to show a proof that it is capable to do any or all the above subcontract works.

3. On the question if there is a specific brand of generator required, NDC BAC answered that it is prohibited to specify brands, however, the generator set should comply with the specifications stated at the bidding document.
4. On the question on what is the length of the feeder line from Deepwell No. 8 to Generator in Pump Complex No. 3? NDC BAC clarified that the feeder line is referring to the XLPE Cable, which length is stated in the Bill of Quantities.
5. On question if there is a final checklist of requirements to be issued by NDC BAC? NDC BAC clarified that there is no more Checklist of Eligibility Requirements to be issued. The Checklist of Eligibility Requirements is included at last page of the bidding documents, and the NDC BAC reminds the bidder that the checklist is only a guide. **It is still the responsibility of each bidder to make sure it complies with the requirements.**

6. On the question if it is allowed to submit a Single Largest Completed Contract (SLCC) that is not exactly with same title as "site development works", NDC BAC answered that SLCC should be projects similar to the contract which includes land development, or other projects with major works involving construction of roads & drainages, even if the title of the contract does not mention "site development works".
7. On the question if costs of similar scope of works of different completed projects can be added up together in order to comply with the required SLCC amount, the NDC BAC answered that it is not allowed because it should be the amount of a single completed contract.

Queries from Verzontal Builders:

Query 1: Kindly provide specs and details for the Deepwell Chlorinating Equipment (Gas Type). (Item No. F.1.6)

Answer:

*The gas chlorinator equipment and gas chlorine are supplied solely by Mabuhay Vinyl Corporation according to the FCIE Association engineer. Attach hereto as **Annex A** are the Minutes of Site Inspection conducted last August 10, 2019 showing pictures of chlorination equipment and set-up. Attached also as **Annex B** is the Enchlor Series 4000 Gas Chlorinator Operation Manual for reference.*

For information, the FCIE Association supplier of gas chlorinator is Chlor-Tech Enterprises; Tel No. (02) 412 0565; Email: chlortech_ent@yahoo.com.

Query 2: What are the works included in our scope with regards to Network Service/Data for Admin Bldg.? Pls.advise. (Item No. E.4.7)

Answer:

The BOQ being used as reference in the query is from the previous bidding documents. The BOQ to be used shall be from the new Bidding Documents with the new NDC Logo (see insert). It is Item No. E.5.2 of the BOQ.



The Network Server Panel (NSP) shall comprise a local area network (LAN) within the Administration Complex. The LAN networking shall comprise cables, switches, routers and other components to connect to internal server, websites and other Local Area Networks (LANs) via wide area networks.

Query 3: For rehabilitation of deepwell # 5 and #7, pls clarify if the dismantling of the existing electrical and mechanical works are included in our scope.

Answer:

The existing electrical and mechanical components shall be thoroughly inspected and evaluated. If these components are deemed no longer serviceable, the dismantling of these items shall be included in the scope.

Query 4: Which of the following will prevail for the Transfer Switches, in the BOQ it is MTS (Manual Transfer Switch) while in the plans , it is ATS (Automatic Transfer Switch). Pls. advise.

Answer:

Manual Transfer Switch (MTS) shall be used.

Query 5: Pls clarify what will be the final rating for the Genset in the STP Area. In the BOQ, it is 200KVA (Item No. L.7), 150KVA on the Plans, and 220 KVA on the PPT Presentation, Aug. 5, '19

Answer:

*Item H.3.7 in the BOQ shall be **220 KVA** (not sound roof) as shown on the revised Drawings issued in Bid Bulletin No. 1 specifically Drawing No. J-13.*

Query 6: Pls clarify what will be the final rating for the Genset in the Admin Area. In the BOQ, it is 100KVA (Item No. E4.20), 100KVA on the Plans, and 150 KVA on the PPT Presentation, Aug. 5, '19.

Answer:

It is 150 KVA as per Item E.5.17 of the BOQ and as shown in Drawing J-1 of the revised drawings.

Query 7: Pls. advise where will we input all the items that are not included in the BOQ but included in the scope and plans.

7.1 CSA Works (Civil, Structural, Architectural) for Fire pump room, Genset Room 100KVA (Admin Area), Guardhouse, MCC Room (MCC-E), Genset Room 150 KVA (STP Area)

Answer:

All above items are included in the BOQ; Item E – Administration Complex and Item H – STP Complex

7.2 50mm² XLPE Cable included in our scope?

Answer:

Yes, refer to Item N of the BOQ

7.3 STP Motor Control Center includes MCC-E , MCP-F and 20kVA Step Down Transformer

Answer:

Refer to Item H.3 of the BOQ and to the revised drawing J-13.

Annexes:

Annex A – Minutes of Site Inspection

Annex B – Enchlor Series 4000 Gas Chlorinator O&M Manual

This **SUPPLEMENTAL BID BULLETIN No. 2** is issued this 16th day of August 2019 for guidance and information of all concerned.


SATURNINO H. MEJIA
Chairperson
Bids and Awards Committee

2nd PUBLIC BIDDING FOR THE SITE DEVELOPMENT WORKS OF THE NDC INDUSTRIAL ESTATE (NDCIE) PROJECT

MINUTES OF SITE INSPECTION

August 10, 2019, 8:30 AM
First Cavite Industrial Estate, Brgy Langkaan
Dasmarinas, Cavite

Present were:

National Development company:

Jonathan C. Eugenio	-	CEO II, Special Projects Group
Frumencio T. Tagulinao	-	Consultant

Prospective Bidders Representatives:

Dennis C. Cadada	-	Mardeb Const. and Development Corp.
Tranquilino A. Lumboy, Jr.	-	Mardeb Const. and Development Corp.
Alex S. Brucal	-	Mardeb Const. and Development Corp.
Wilson C. Cadorniga	-	Two Aces Const. & Supply
Ricardo San Sebastian	-	JD Legaspi Construction

FCIE Association Representatives:

Annel Narrido (0956 982 556)	-	Water Supply Engineer
Ricardo Encabo	-	Pump Operator

Site Inspection:

The Site Inspection led by Engr. Tagulinao and Engr. Eugenio started at 08:45AM with the assistance of the water supply engineer and pump operator of FCIE Association.

The following sites were inspected:

1. Deepwell Pump Station No. 5 (*Item F of BOQ*)

The following are the major scope of work:

- a. Construction (Replacement) of new deep well; 200m deep on 250mm dia. casing (*Item Q of BOQ*). Approximate location is shown on the plan.
- b. Mechanical installation
 - Piping from old well to new well location;
 - Supply and installation (Replacement) of submersible pump and motor. The pump capacity shall be limited to 15 liters per second (lps). All existing pump and motor brands installed in FCIE are Grundfos and Franklin, respectively. The FCIE Association recommends to use these brands for easier maintenance.
 - Supply and installation of Chlorinating Equipment (Gas-type);

- Supply and installation of Sand Filter may be considered later on upon further testing/evaluation and will be treated as Extra Work Order during implementation, as necessary.

c. Electrical

- Motor Control Panel (MCP) with Slow Starter
- Manual Transfer Switch (MTS) – According to FCIE personnel, the existing MTS is still in working condition. *(This shall be included in the bid but will be tested during construction. A variation order will be issued after verification).*
- Other miscellaneous works



Fig. 1 – Existing MTS of DW 5 to be checked; MCP to be replaced



Fig. 2 – Existing mechanical set-up of DW 5; to be checked if still usable



Fig. 3 – Existing deep well to be replaced



Fig. 4 – Gas Chlorinator from Mabuhay Vinyl Corporation (sole supplier) from Deepwell No. 9

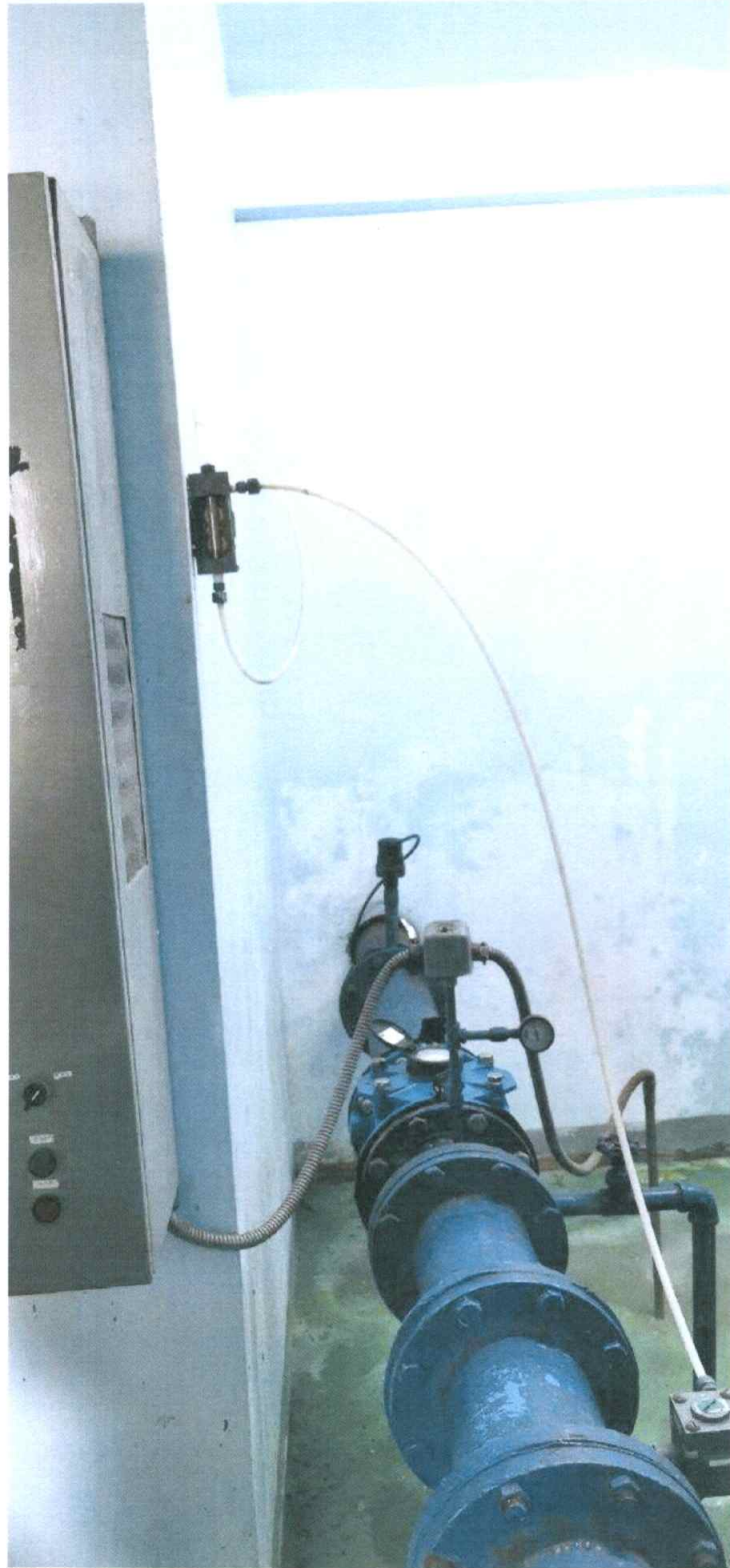


Fig. 5 – Gas Chlorinator connection from Deep Well No. 8



Fig. 6 – Gas chlorinator 2-Hp booster pump from Deep Well No. 8

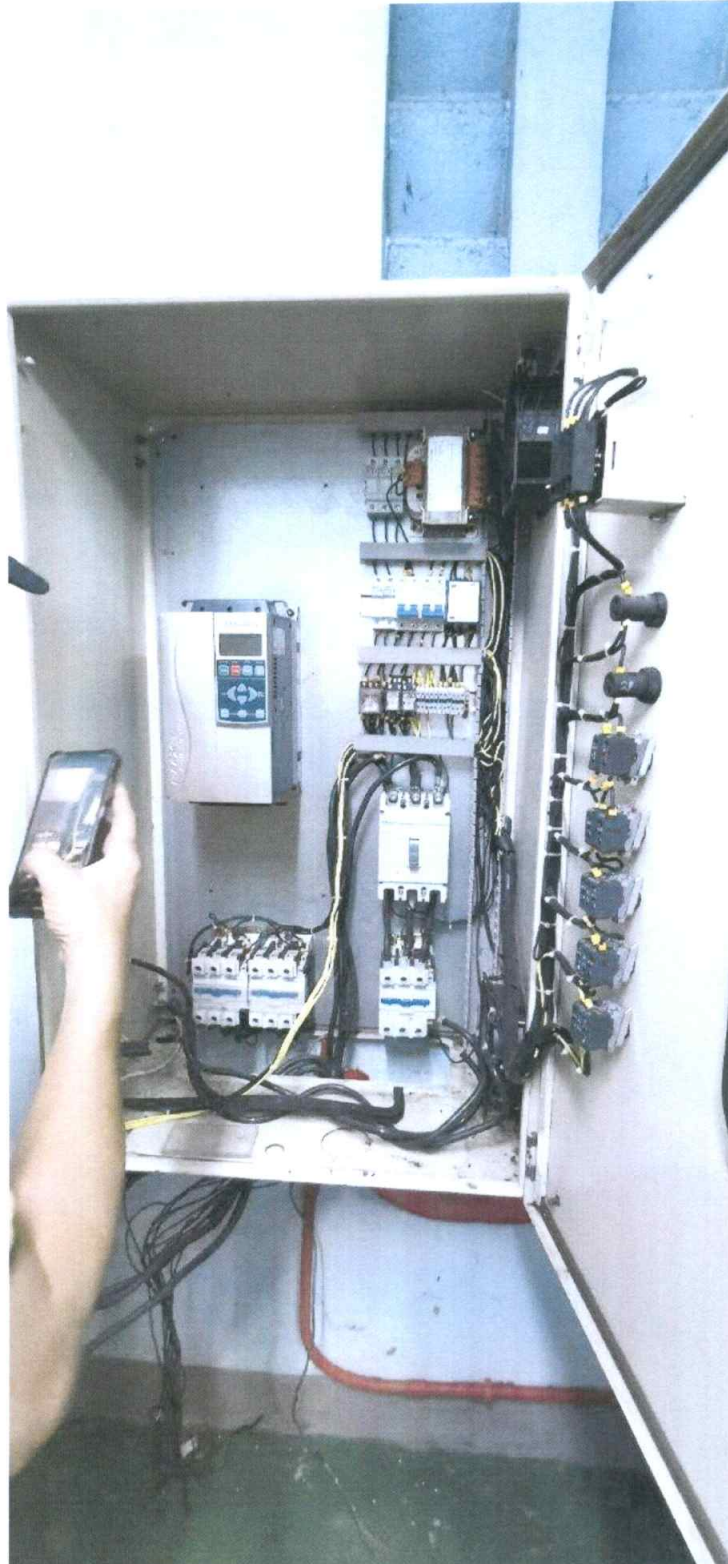


Fig. 7 – Sample of Motor Control Panel with Slow Starter from Deep Well No. 3



Fig. 8 – Typical set-up of 2-100 mm dia. Sand Filter form Amiad

2. Deepwell Pump Station No. 7 (*Item G of BOQ*)

The following are the major scope of work:

- a. Construction of new deep well; 200m deep on 250mm dia. Casing (*Item Q of BOQ*). Approximate location is shown on the plan.
- b. Mechanical installation
 - Piping from old well to new well location; piping inside the pump house
 - Supply and installation (Replacement) of submersible pump and motor. The pump capacity shall be limited to 15 liters per second (lps). All existing pump and motor brands installed in FCIE are Grundfos and Franklin, respectively. The FCIE Association recommends to use these brands for easier maintenance.
 - Supply and installation of Chlorinating Equipment (Gas-type);
- c. Electrical – All electrical works shall be reinstalled/reconstructed.
 - Motor Control Panel with Variable Speed Drive (VSD)
 - Manual Transfer Switch (MTS)
 - New Service Connection including service entrance post
 - Other miscellaneous works
- d. Civil Works

The location of the pump house is regularly flooded during rainy season. It is recommended to raise the area and the pump house flooring by at least 0.80m. This will be treated as extra work order during construction implementation. The works are as follows:

- Engineered fill
- Raising of pump house flooring and doors
- Removal and reinstallation of existing fence



Fig. 9 – Status of DW 7 pump house



Fig. 10 – Existing deep well to be replaced

3. Pump Complex No. 3 Genset to Deepwell No. 8 (*Item N of BOQ*)

NDCIE water supply will be sourced from Phase 3. At least one deep well shall be connected to the generator to supply water during power outages. The existing connection for Phase 3 is grounded. This shall be replaced with new XLPE cable as shown on the plan.

It is noted that the existing generator is **Cummins** brand. The FCIE Association recommends to use these brands for maintenance convenience.



Fig. 11 – Diesel Generator at Pump Complex No. 3

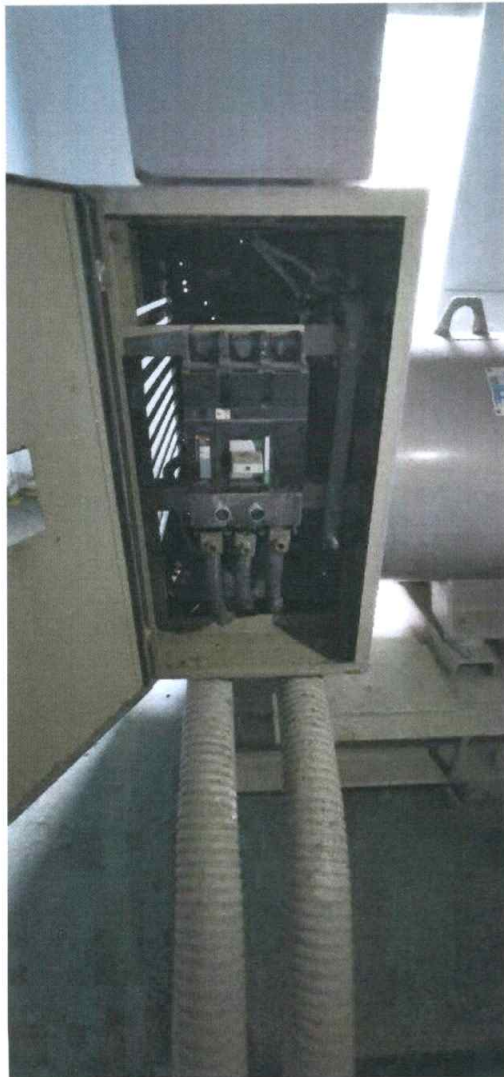


Fig. 12 – XLPE cable connection from generator set at Pump Complex 3



Fig. 13 – Transfer switch at DW #8; on right side is XLPE cable connection

4. Site Inspection

Site inspection of the NDCIE site followed after inspection of Pump Complex No. 3 and Deepwell No. 8.

- a. The corner radius of the road going to the NDCIE entrance gate shall be increased to accommodate 40-footer container trucks. This shall be treated as extra work order during contract implementation.
- b. All contractor's equipment, materials and deliveries shall utilize the existing barangay road (shown in the figure below) during construction of the project. However, all equipment and material deliveries for the reconstruction of deepwells and deepwell pump houses may pass

through FCIE. The use of barangay road should be coordinated with the Brgy. Captains of Langkaan 1 and 2.

- c. The existing barangay road and property boundaries were shown to the contractors as well as the location of retaining wall.



Fig. 14 – Corner radius of existing FCIE road to be widened



Fig. 15 – Barangay road to be utilized during construction



Fig. 16 – Location of retaining wall on eastern boundary

There having been no other remaining topics for discussion, the site inspection adjourned at 11:00 AM.

Prepared by:


JONATHAN C. EUGENIO



Gas Chlorination Systems Series E4000 Instruction Manual

All ENCHLOR Chlorination systems are carefully designed and tested for years of safe, accurate field service. All ENCHLOR Chlorination systems are chlorine tested, at customer specified conditions, prior to shipment. All ENCHLOR products are made of the finest materials. To insure best operation, read these instructions carefully and completely and store them where all maintenance personnel will have access to them.

Each E4000 Series gas chlorination system consists of the following:

1. The vacuum regulator(s) which mount on the chlorine cylinders.
2. A wall mounted flow meter with manual control valve.
3. The ejector, with nozzle and diffuser, mounts directly to the pipe line, tank, wet well, or to a solution line.
4. Standard accessories:
 - a. Appropriate polyethylene tubing for vacuum lines.
 - b. Ten lead gaskets for each vacuum regulator.
5. Additional parts available from any plumbing supply, or can be ordered through Enchlor.
 - a. Pressure gauge.
 - b. Water shut off valve.
 - c. Y-type strainer.

**Gas Chlorination Systems
Series E4000
Operation & Maintenance Manual**

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SECTION I: SAFETY INFORMATION

TAKE CARE WITH CHLORINE!

1. Always keep chlorine cylinders in an upright position with the valve cap screwed on tight before moving full or empty cylinders. Cylinders should be moved with care.
2. A safety chain must be placed around the cylinder and secured to a wall. Spare full cylinders should also be secured carefully.
3. For best operation and safety, the vacuum regulator and cylinders should be protected from the elements including direct sunlight.
4. Never place heaters or heat lamps directly on a cylinder.
5. Ammonia gas should NOT be stored or fed in the same room with chlorine. Contact of the gases may result in an explosive mixture.

IMPORTANT NOTE:

Take extreme caution when using chlorine gas manifolds. Manifolds contain pressurized chlorine gas there- by increasing the risk of a pressurized chlorine leak. Enchlor vacuum regulators are designed to mount directly onto the valve of chlorine and sulfur dioxide cylinders. Direct cylinder mounting is the easiest and safest configuration to operate and maintain. With this configuration, the chlorine gas flows under vacuum everywhere beyond the one pressure point at the chlorine cylinder valve.

SECTION II: DESIGN AND INSTALLATION NOTES

1. The "all vacuum" system means that system will shut off at the cylinder valve, should the vacuum line be broken, if water is stopped for any reason, or if the chlorination equipment is physically damaged.
2. Choosing the right feed rate capacity:

VACUUM REGULATOR SHOULD BE ON MAXIMUM POSSIBLE FLOW.

Imperial Units:

$$\text{GPM} \times 0.012 \times (\text{PPM}) \text{ Dosage} = \text{PPD}$$

Gallons Per Minute Parts Per Million Pounds Per Day (Cl 2)

Example: $600 \text{ GPM} \times 0.012 \times 3 \text{ PPM} = 21.6 \text{ PPD}$

In this example a 50 PPD system would be appropriate.

Metric Units:

$$\text{LPM} \times 0.0599 \times (\text{PPM}) \text{ Dosage} = \text{GPH}$$

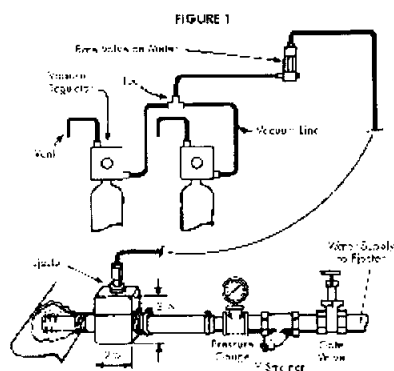
Liters Per Minute Parts Per Million Grams Per Hour (Cl 2)

3. TOTAL BACK PRESSURE is the pressure in the pipeline to be chlorinated plus the friction losses in the solution line between the ejector and the point of injection at the pipeline. Ejectors capable of operating with backpressures up to 140 Psig are standard. For higher backpressure consult factory.

4. It is preferable to locate the ejector at the point of solution injection in order to eliminate the need for solution lines. Friction losses in the solution line will increase the ejector backpressure. To reduce the friction losses, increase the solution line internal diameter and limit the number of flow restrictions and turns. Also be sure that the solution line material is resistant to the highly concentrated chlorine

mixture. Avoid solution lines wherever possible.

5. The chlorine gas is carried from the vacuum regulator to the ejector through the specified black polyethylene tubing. Up to 100 feet of polyethylene tubing between vacuum regulator and ejector is standard. For longer distances consult factory.



A typical installation injecting chlorine into a pipe line using city water.

(I) INSTALLATION OF EJECTOR (Refer to Figures 1 and 2)

1. Installation of EJECTOR:

- Remove the diffuser from the ejector assembly and place 2 wraps of Teflon tape on diffuser threads.
- Do Not install diffuser into pipe line when assembled with ejector.
- Turn diffuser by hand into NPT threads of pipe line (3/4" or 1 1/4" NPT). Place wrench on diffuser and tighten one half turn maximum.
- Reconnect diffuser to ejector making sure appropriate O-rings are on each side of nozzle and diffuser.

2. Testing of ejector. (Note: The vacuum regulator should still be in the shipping case.)

- Piping hook up to ejector (Refer to Figures 1 and 2 and Servicing Section in this Manual).
 - Ejector should be installed down stream at a sufficient distance so that chlorinated water is not re-circulated through the booster pump. (See Figure 2.)
 - On the water inlet side to the ejector nozzle the following should be installed: a gate valve, Y-strainer, and a pressure gauge.
- Testing for sufficient pump pressure to operate ejector. Also checking that booster pump (if applicable) operating in the proper direction. Refer to ejector performance charts and tables at end of this manual.

Note 1: Ejector must have some back pressure to prevent jetting. (Jetting causes loss of vacuum)

Note 2: When chlorinating into a contact chamber a tee should be installed on the solution line with a vacuum breaker to prevent siphoning.

- If operating with city water pressure (no booster pump), open the water inlet valve to the ejector and feel for suction (with your finger) at the fitting on the top of the ejector.
- If pump is operating in proper direction there should be a strong vacuum at the fitting on the top of the ejector. Feel for suction (with your finger) at the fitting on the top of the ejector.
- If the ejector has tested satisfactorily continue on to the next step (Mounting the Vacuum Regulator).

SECTION III: SYSTEM INSTALLATION

(II) INSTALLATION OF VACUUM REGULATOR

NOTE: The chlorine cylinder valve is CLOSED. Do not open until instructed to do so.

1. See that safety chain is secured around chlorine cylinder.
2. Remove the cylinder protection cap from the chlorine cylinder.
3. Examine the vacuum regulator for obvious damage.
4. Remove masking tape used for shipping purposes.
5. Place lead gasket over vacuum regulator inlet assembly.
6. While placing lead gasket on vacuum regulator see that the filter has not fallen out of inlet assembly. (This filter is necessary to remove particles that will cause venting.) The filter should be inspected each time the cylinder is changed.

7. Mount vacuum regulator on cylinder valve being sure the yoke screw is backed out far enough for sufficient clearance. While tightening the yoke screw be certain that the lead gasket stays in place. Excessive tightening can damage gasket and/or yoke screw. DO NOT USE EXCESSIVE FORCE. See torque specifications below.

(III) CONNECTING VACUUM LINES BETWEEN VACUUM REGULATOR AND EJECTOR AND VACUUM REGULATOR VENT TO OUTSIDE (Refer to Figures 1 and 2)

1. The side connector of vacuum regulator is for vacuum line tubing to ejector. (Allow enough vacuum tubing for changing cylinders.)

2. Connect vent tubing to second connector on the vacuum regulator and vent to safe area outside of building. (Place bug screen outside on end of vent tubing.)

NOTE: Do Not connect vent lines from two vacuum regulators to one common vent. You must run separate vent lines to the outside, when using multiple vacuum regulators.

(IV) REMOTE METERS (Refer to Figure 2)

1. Remote Meters: (Gas flow is from bottom to top through the tube)

a. Connect the line in to the bottom tube connector.

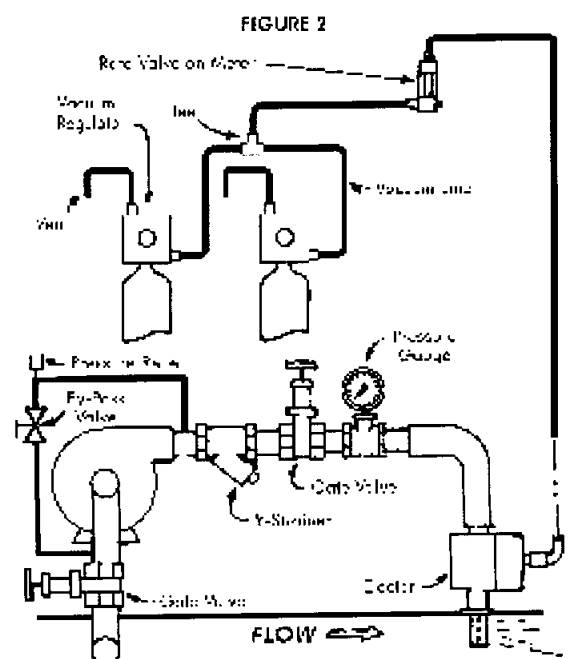
b. Connect the line out to the ejector to the top connector.

A Switchover System injecting chlorine into a pipeline using a turbine positive displacement pump.

Pressure relief valve must discharge to a drain or outside of building. Note the by-pass piping from pump discharge through by-pass valve back to suction side of pump.

NOTE: By-pass valve must never be completely closed.

NOTE: Pump suction and ejector must be from the side of the pipeline, not from the top of the line.



SECTION IV: CHLORINATION SYSTEM VACUUM TEST

1. Do Not open chlorine cylinder valve until vacuum test is satisfactorily completed.

a. Vacuum Test

With the chlorine cylinder still closed, start the ejector booster pump and the meter tube ball should drop to the bottom within about ten seconds. If the ball continues to bounce there is either a leak at the lead gasket or a loose connection at the vacuum tube fittings or meter tube. (The tube fittings should be hand tight. It is not necessary to use pliers or a wrench on these fittings. If meter tube needs tightening, use a quarter and finger tighten inlet plug.) At this time the rate valve on the vacuum regulator should be open two or three turns.

b. If the ejector is operating properly (pulling sufficient vacuum) then the front bolts should be depressed on both vacuum regulators.

c. Turn off water supply to ejector.

d. Wait 5 to 10 minutes with water supply off. The ball should remain still at the bottom of the meter tube.

e. If the system is vacuum tight proceed to the next step.

f. Disconnect vacuum tubing at the vacuum regulator to allow air to enter the system. Reconnect tubing.

g. Place one of the vacuum regulators in standby by turning the front knob two turns counter-clockwise and then returning it two turns clockwise. The front bolt should remain protruding per the diagram on the vacuum regulator.

SECTION V: START UP OF CHLORINATION

Material necessary: A small plastic squeeze bottle, 1/3 full of household ammonia, for detecting chlorine leaks. When ammonia fumes contact chlorine gas a visible smoky vapor is produced. (Wipe up any splashed liquid ammonia.)

1. Open chlorine cylinder valve 1/4 turn and close immediately.

2. Squeeze ammonia bottle at gasket and yoke assembly area: if no vapor appears the seals are tight and it is OK to proceed to the next step.

3. Open chlorine cylinder valve 1/4 turn, leave open, and recheck for chlorine leaks. (1/4 turn open of the cylinder valve is all that's required. The reason we specify 1/4 turn is that the valve can be closed with only 1/4 turn. In an emergency you can shut it off quickly and safely. The wrench stays on the cylinder valve while cylinder is open.)

4. Place one vacuum regulator in standby. This is done by turning the reset knob two turns counter-clockwise and then returning it two turns clockwise. The front bolt should remain protruding per the diagram on the vacuum regulator.

5. Turn on water supply or booster pump to ejector and set rate valve to desired flow rate. Read flow rate at center of ball on meter tube scale.

6. Rate valve is not a shut off valve: it is a flow rate control only. To shut off chlorine feed close the chlorine cylinder valve.

SECTION VI: SHUT DOWN PROCEDURE

1. Close both chlorine cylinder valves while pump is still running.
2. Wait for ball to rest at bottom of meter tube and the front bolt to be below the surface.
3. Break vacuum by removing the tubing at one of the vacuum regulators and reattach. (Repeat at least 2 times for more complete removal of gas from the system.)
4. Shut down the water supply to the ejector.

This procedure of shut down must be followed before a vacuum regulator is removed from a cylinder.

NOTE: After installing the vacuum regulator with a new lead gasket on a new cylinder, the vacuum tubing should be removed to allow air to enter the system and break the vacuum. Not releasing vacuum and turning on cylinder will slam the diaphragm forward and could cause damage to the diaphragm assembly. You can also accomplish breaking the vacuum by turning the rate valve out of the bonnet. Either way is acceptable.

SECTION VII: CHANGING CYLINDERS

When one cylinder is empty and the system has switched to feed from the other cylinder then the empty cylinder must be replaced and that vacuum regulator must be placed in standby mode.

1. Tightly close the valve of the empty chlorine cylinder. Follow all applicable guidelines in changing chlorine cylinders.
2. After replacing the empty with a full cylinder, inspect the vacuum regulator, the vacuum regulator filter and (using a new lead gasket) mount the vacuum regulator on the full cylinder.
3. Turn the front knob two turns counter-clockwise and then return two turns clockwise to place the vacuum regulator in standby. The front bolt should remain protruding per the diagram on the vacuum regulator.

SECTION VIII: RATE VALVE OPERATION

Turn the rate valve counter-clockwise to open it completely. Further turns will completely remove the rate valve from the flow meter tube, which will cause a loss of Cl₂ feed. (See Appendix for servicing instructions.)

The O-ring seals for the rate valve are locked in place under the valve bonnet and do not come out when the rate valve is pulled out of the bonnet.

PREVENTATIVE MAINTENANCE NOTE: Rate valves which are not exercised frequently may experience a build up of a white powdery substance which precipitates out of the chlorine gas. In order to avoid this build up, which can cause the rate valve to become stuck in place, it is recommended that the rate valve be periodically exercised. See Appendix for rate valve maintenance instructions.

SECTION IX: TROUBLESHOOTING

(I) PRESSURIZED LEAKS

1. Pressurized chlorine leaks are a safety hazard to life and equipment and should be corrected immediately. When searching for this type of leak there are basic safety rules to follow.
 - a. Air breathing pack should be readily available and personnel should know how to use it properly.
 - b. Exhaust fan switch should be located near outside entrance with alternate outside switch

- c. Chlorine cylinder wrench should remain on the cylinder whenever cylinder is open.
- d. Plastic squeeze bottle 1/3 full of household ammonia.
- e. Buddy system used (two people capable of operating system).
- 2. If a leak is detected the following should be checked first:
 - a. The lead gasket between the chlorine cylinder valve and the vacuum regulator inlet assembly.
 - i. Tighten the half dog screw on the vacuum regulator yoke assembly which is used to secure the inlet assembly to the chlorine cylinder valve.
 - ii. Always use a new lead gasket.
 - b. Chlorine cylinder valve packing.
 - i. Tighten the cylinder valve with care, not excessively! Close the valve if problem persists and notify your chlorine supplier.
 - ii. If valve is the problem try to move cylinder with a high degree of safety to an outside location.
- c. Chlorine leaking out the vent due to the inlet safety shut off valve having dirt on the valve seat.
 - i. Close the chlorine cylinder valves.
 - ii. Wait until the metering ball drops to zero on the flow tube.
 - iii. Turn off water supply to ejector.
 - iv. Now remove the leaking vacuum regulator from the cylinder valve.
 - v. See Appendix for inlet safety shut off valve servicing instructions.
 - vi. After servicing and remounting chlorinator with a new lead gasket, pull a vacuum test before you open the chlorine cylinder valve. See Section IV: "Chlorination System Vacuum Test".

(II) NO CHLORINE FEED

Possible causes:

- 1. No vacuum being produced by ejector.
 - a. Remove poly tubing from ejector fitting and place your finger on it; you should feel a strong suction.
 - b. If you feel no suction (vacuum) check in this order:
 - i. Nozzle (See Appendix): Turn off water supply and remove nozzle from ejector.
 - (1) It may be clogged or damaged by a stone or other foreign matter. Flush out or run pipe cleaner through carefully.
 - (2) If there is a build-up of rust, iron, or manganese, place the nozzle in a Muriatic acid for five minutes and rinse with water. If you see a black syrup substance you may find it necessary to clean the nozzle on a preventative maintenance schedule.
 - ii. Inlet Water Supply. Check that it is sufficient. Refer to nozzle curves in back of manual.
 - iii. Reduced city water pressure.
 - iv. Y strainer needs cleaning.
 - v. Booster pump cavitating (lost its prime).
 - vi. Booster pump insufficient boost due to wear or single phasing due to loss of one leg of power.
 - vii. Booster pump may have flooded suction.
- 2. Chlorine flow blocked at vacuum regulator inlet assembly.
 - a. The Inlet filter could be clogged.
- 3. Out of Chlorine.
 - a. The scale would read 150 lbs. lighter than when cylinder was new.
 - b. Meter tube ball would be at zero.

APPENDIX A – SERVICING THE SYSTEM

SECTION A-1: VACUUM REGULATOR

(I) CLEANING THE RATE VALVE

1. Unscrew the rate valve knob and stem (by hand) completely out of the rate valve bonnet.

NOTE: Be careful not to let the meter tube drop in the next step. It will come loose.

2. Unscrew the rate valve bonnet using pliers (carefully and using a cloth to protect the part). The rate valve sleeve should also be removed.

3. Replace the ORE-VIT-008 O-Rings on the rate valve stem by separating the valve bonnet and sleeve.

4. Lubricate the new O-Rings lightly with Flourolube grease before replacing the sleeve, bonnet and rate valve.

(II) CLEANING THE METER TUBE

1. Remember to be careful not to lose the stops or ball in the following steps.

2. Remove the white stops at either end of the tube (you could use a paper clip).

3. Soak the tube in warm water with a cleaner like lime away or Muriatic Acid. Also, brush the inside of the tube with a pipe cleaner.

NOTE: Always follow safety precautions with Muriatic Acid and other chemicals.

4. Dry the meter tube and reinstall the ball and stops.

5. It is recommended that new meter tube gaskets be used when reinstalling the meter tube.

6. Reinstall the meter gaskets and meter tube, making sure to center the tube on the top and bottom meter gaskets.

7. Tighten the rate valve bonnet with reasonable force to make a seal. Do not use excessive force.

NOTE: All other vacuum regulator repairs should be done by the factory or authorized repair personnel.

WARNING: If the vacuum regulator leaks gas out the vent or any other place on the body the problem is most likely caused inside the yoke assembly. It is not recommended that the yoke assembly be disassembled because if it is not done properly dangerous leakage of pressurized gas could result.

SECTION A-2: INLET ASSEMBLY

WARNING: If the vacuum regulator leaks gas out the vent or any other place on the body the problem is most likely caused inside the yoke assembly. It is recommended that the yoke assembly be disassembled by a person experienced in Chlorine Vacuum Regulator maintenance because if it is not done properly dangerous leakage of pressurized gas could result.

1. Remove the inlet assembly from the yoke plate by slipping off the PVC retainer clip (VRE-142-500) that holds it to the yoke.

2. Remove the inlet filter material from the inlet capsule (VRE-141-501).

3. Disassemble the inlet assembly using a small flat-head screwdriver to hold the inlet valve (VRE-112-500) and a pair of pliers (and a protective cloth) to grip the vent plug (VRE-111-500) to unscrew these two parts. Take care as this assembly is under spring tension and small parts may be difficult to find if dropped.

4. Unscrew the seal plug (VRE-182-500) from the inlet capsule.

5. Remove the valve seat (VRE-110-500) from the inlet capsule by simply pushing the exposed threaded portion up through the inlet capsule. Note that the O-ring ORE-VIT-011 is attached to this

seat.

6. Clean the inlet capsule, inlet spring (SPE-104-100) and inlet valve using a soft cloth or plastic cleaning pad. Do not use steel wool or other metal cleaning sponges on the inlet valve.
7. Using all new O-rings and new parts as needed, reassemble in reverse order.

SECTION A-3: REMOTE METER

(I) CLEANING THE RATE VALVE

1. Unscrew the rate valve knob and stem (by hand) completely out of the top meter block.
2. In low capacity systems (10 PPD or below) check to see if the point of the valve stem is broken or bent. If it is damaged it must be replaced.
3. Replace O-Rings on the rate valve stem.
4. Lubricate the new O-Rings lightly with Fluorolube grease before replacing the rate valve and knob into the top meter block.

(II) CLEANING THE METER TUBE

1. While holding the glass meter tube (to prevent it from falling) unscrew the inlet plug at the base of the bottom meter block, until the meter tube can be removed.
2. Remember to be careful not to lose the stops or ball in the following steps.
3. Remove the white stops at either end of the tube (you could use a paper clip).
4. Soak the tube in warm water with a cleaner like lime away or Muriatic Acid. Also, brush the inside of the tube with a pipe cleaner.

NOTE: Always follow safety precautions with Muriatic Acid and other chemicals.

5. Dry the meter tube and reinstall the ball and stops.
6. It is recommended that new meter tube gaskets be used when reinstalling the meter tube.
7. Remove the inlet plug completely and inspect the O-Rings. If it has been more than 12 months since they were changed or if there is any noticeable damage, the O-Rings should be replaced.
8. Reinstall the inlet plug, meter gaskets and meter tube, making sure to center the tube on the top and bottom meter gaskets.
9. Tighten the inlet plug with reasonable force to make a seal. Do not use excessive force.

SECTION A-4: EJECTOR/CHECK VALVE ASSEMBLY

(I) LOSS OF VACUUM AT THE EJECTOR: If vacuum is lost at the ejector and water supply is sufficient, then the nozzle is most likely clogged, broken or loose. Before working on the ejector it must first be isolated so that water will not leak when the ejector is removed.

1. First detach the intake side (nozzle) of the ejector from the pipe line.
2. For 3/4" line size ejectors rotate the complete ejector body counter clockwise. This loosens the threaded portion of the nozzle from the diffuser. It also eliminates the need for pliers on the nozzle which could damage the plastic. For 1 1/4" line size ejectors remove the two flanges to remove the ejector.
3. Inspect the nozzle for:
 - Pipe scale, stones, dirt, etc...
 - Build-up of iron, manganese, calcium, etc...
4. The nozzle should be soaked and brushed with warm water mixed with a cleaner like Muriatic Acid.

NOTE: TAKE CARE NOT TO SCRATCH OR ATTEMPT TO MODIFY THE ORIFICE IN ANY WAY.

5. Using two new ORE-BUN-121 O-rings the ejector can now be reassembled.
- When reassembling 3/4" line size ejectors the nozzle and diffuser should be screwed together hand

tight leaving the ejector body 90 degrees to the left of its final position. Once the nozzle and diffuser are hand tight, the ejector can then be turned the final 90 degrees.

WARNING: Do not use excessive force in tightening the nozzle, diffuser and ejector assembly. The ejector is constructed of PVC and excessive force can break the parts.

(II) SERVICING THE EJECTOR CHECK VALVE ASSEMBLY: If water leaks back into the system, this means that the ejector check valve has failed. This could be caused by incorrect assembly, a failed gasket, O-Ring or diaphragm, or foreign material lodged in the check valve.

1. Remove the four bolts holding the ejector body together.
2. Inside you will find a diaphragm assembly and a spring.
3. The diaphragm assembly can usually be unscrewed by hand. If it is too tight, carefully try large jaw pliers or a vice. Note that a plastic support diaphragm is on the top side of the rubber diaphragm. The purpose is to protect the softer rubber diaphragm in installations with high pressure.
4. Inspect the rubber diaphragm for holes or weak points.
5. Inspect the ORE-CEM-210 O-Ring. Replace if damaged.
6. Reassemble the diaphragm assembly, preferably with a new rubber diaphragm, DIE-104-500.
7. Install the assembly in the recess between the ejector body halves being careful to install the spring properly below the assembly.

SECTION A-5: SWITCHOVER MODULE

(I) OPERATION OF THE MODULE

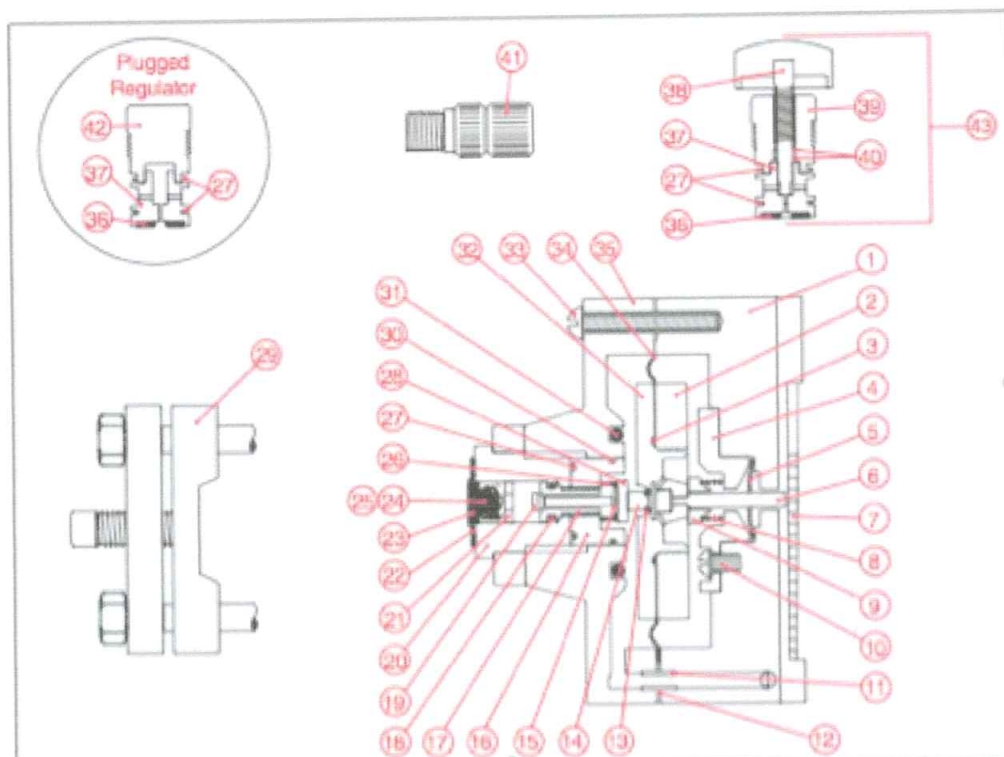
GENERAL: This device requires no outside setting or adjustment. The switchover module allows gas to flow from one of the two intake ports at a time, keeping the other sealed. It will continue to feed from first side until the vacuum level rises sufficiently (in the event of an empty cylinder or closing of the cylinder valve), at which time an internal spring loaded mechanism automatically switches to open the second intake port and to close the first intake port.

NOTE: In low capacity systems where the feed rate is less than 10 PPD or the time between switching is more than two weeks, it is recommended that the module be "exercised" weekly. If the module is left in one position for long periods of time, it may have a tendency to stick in one position. To exercise the module it can be disconnected from both vacuum regulators with the ejector still connected and operating. Use a finger or thumb to close the open intake port of the module until it switches to feed from the other port. Repeat this process 5 to 10 times.

(II) SERVICING THE MODULE

GENERAL: If the module does not operate correctly first try exercising it as described in the last paragraph. If this does not work the unit must be disassembled.

1. Remove the four screws that secure the top cap onto the main body.
2. Remove the four screws that secure each of the side caps onto the main body.
3. Remove the diaphragm assemblies and the toggle mechanism noting their orientations for reassembly.
4. Inspect the guide pin to ensure that it is free of dirt or burrs. If not clean and polish it with alcohol until it is able to slide freely.
5. Inspect the O-Ring seats on the diaphragm assemblies. Ensure that they are free of any residue and should be cleaned with alcohol being careful not to scratch them.
6. Replace the O-Rings unless they are less than 12 months old or are in perfect condition.
7. Inspect the diaphragms to ensure that they are free of tears or holes. If they are not in good condition, they should be replaced.
8. Reassemble the module in reverse order.



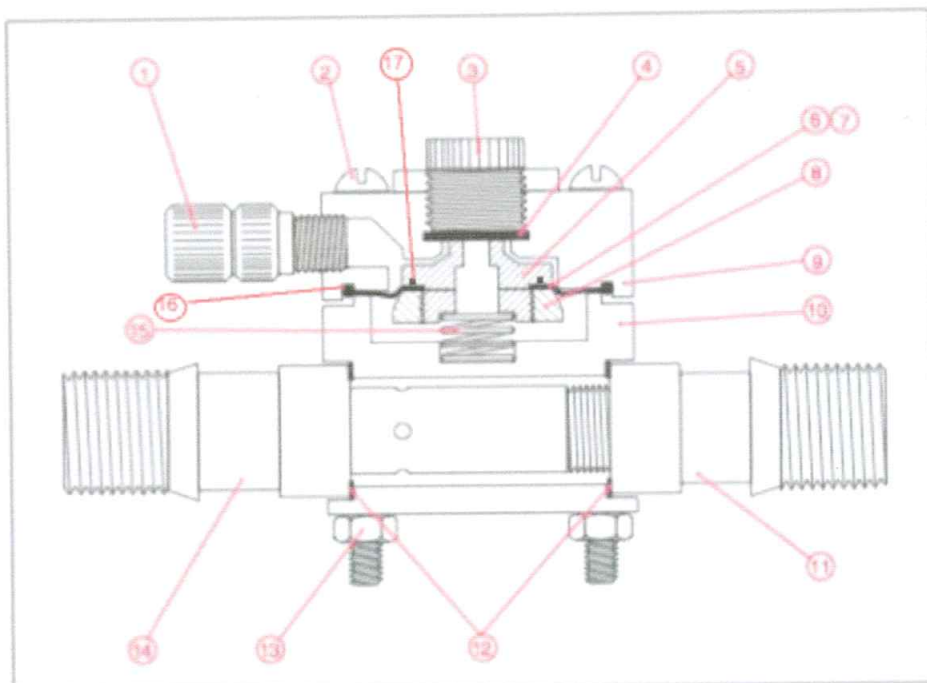
1	Front Body	VRE-822-100	31	O-Ring	ORE-VIT-325
2	Diaphragm Front Plate	VRE-325-100	32	Diaphragm Back Plate	VRE-328-100
3	O-Ring	ORE-VIT-028	33	Screw, 1/4-20 x 1 1/4 lg (6)	BTE-STA-130
4	Seal Cover	VRE-351-100	34	Diaphragm	DIE-108-100
5	Sealing Diaphragm	DIE-102-500	35	Back Body	VRE-198-200
6	Guide Pin	VRE-153-100	36	Meter Gasket, 4 & 10 ppd	GAE-VIT-101
7	Meter Tube, 4 ppd	MTE-108-004	36	Meter Gasket, 25 ppd	GAE-VIT-102
7	Meter Tube, 10 ppd	MTE-108-010	36	Meter Gasket, 50&100ppd	GAE-VIT-103
7	Meter Tube, 25 ppd	MTE-108-025	37	Valve Sleeve	RVE-350-100
7	Meter Tube, 50 ppd	MTE-108-050	38	Rate Valve Assembly	RVE-665-100
7	Meter Tube, 100 ppd	MTE-108-100	39	Valve Bonnet	RVE-349-100
8	Relief Spring	SPE-100-100	40	O-Ring (2)	ORE-VIT-008
9	Spring Retainer	VRE-352-100	41	3/8" Tubing Connector	TCE-100-100
10	Screw, 1/4-20 x 3/8" lg (3)	BTE-STA-157	42	Bonnet Plug	PLE-430-100
11	Flow Tube	VRE-162-500	43	Assembly	RVE-665-002
12	O-Ring	ORE-VIT-012	44	Yoke Bolts (Not shown)	
13	O-Ring	ORE-VIT-009		Screw, 1/4-20 x 2 1/4 lg (2)	BTE-STA-129
14	Vent Plug	VRE-111-500			
15	Holder	VRE-113-500			
16	Adapter Seal Plug	VRE-182-500			
17	Valve Seat	VRE-110-500			
18	O-Ring	ORE-VIT-011			
19	Valve Plug	VRE-112-500			
20	Inlet Capsule	VRE-141-501			
21	Filter Stop	VRE-184-500			
22	Lead Gasket	GAE-LED-111			
23	Teflon Filter	VRE-456-100			
24	Inlet Filter	VRE-101-500			
25	Filter Floss	VRE-455-500			
26	Inlet Spring	SPE-104-000			
27	O-Ring (3)	ORE-VIT-112			
28	Retainer	VRE-183-500			
29	Yoke Assembly	VRE-365-200			
30	O-Ring	ORE-VIT-212			

RVE-665-002 includes #'s 26,37,38,39,40

Repair Kit KTE-100-VR4 includes items:
12, 13, 17, 18, 21, 27, 30, 36, 40, 41

VACUUM REGULATOR: 100ppd max. capacity

Enclor Inc.	Series E4000
Ecometrics:	Series 4000
Capital Controls:	Series 480
Hydro Instruments:	Series 800



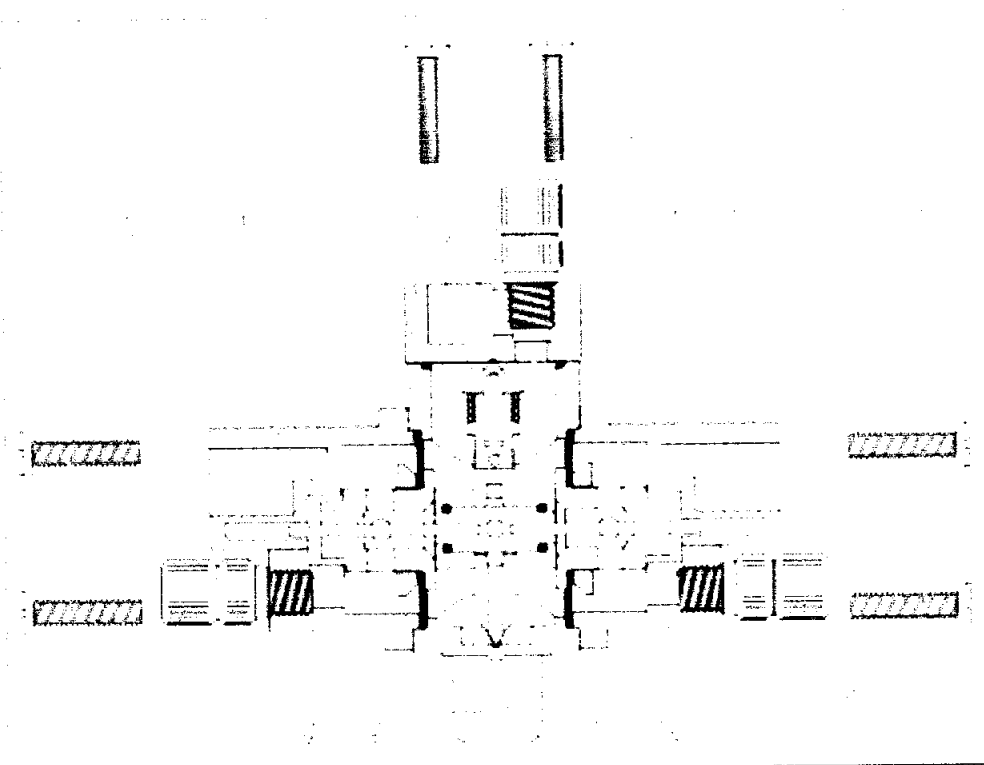
1	3/8" Tubing Connector	TCE-100-100
2	5/16 - 18 x 3 1/2" Bolt	BTE-STA-135
3	Seat Plug	EJE-311-200
4	Valve Seat	GAE-VIT-122
5	Diaphragm Bolt	EJE-206-200
6	Diaphragm	DIE-104-500
7	Support Diaphragm	DIE-105-500
8	Diaphragm Nut	EJE-146-500
9	Top Body	EJE-208-200
10	Bottom Body	EJE-153-500
11	Multi Purpose Diffuser	EJE-982-100
12	O-Ring	ORE-BUN-121
13	5/16 - 18 Nut	NTE-STA-104
14	Nozzle *	See Note
15	Spring	SPE-106-000
16	O-ring	ORE-VIT-137
17	O-ring	ORE-VIT-022

*Note: Available Nozzles:
 CNE-016-106 (10 ppd max.)
 CNE-013-128 (25 ppd max.)
 CNE-015-156 (50 ppd max.)
 CNE-012-191 (100 ppd max.)

EJECTOR: 100ppd max capacity

Enchlor Inc. Series E4000/E2000
 Ecometrics: Series 4000/Series 2000
 Capital Controls: Series 480/Series 201
 Hydro Instruments: Series 800/Series 300

Repair Kit #KTE-100-EJS includes items 1,4,6,12

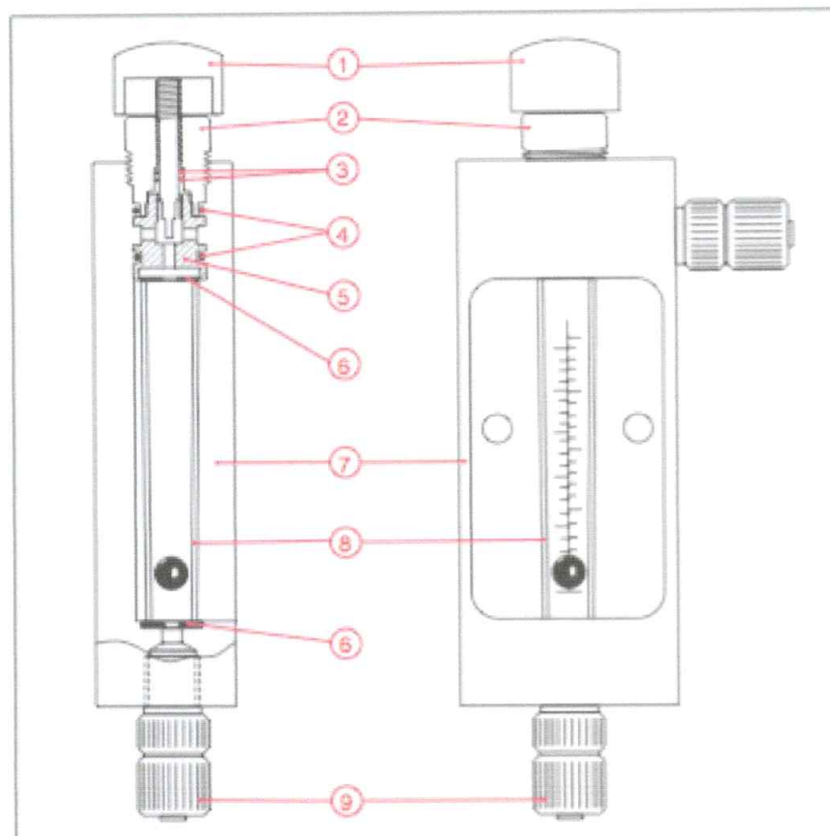


1	Guide Pin	SOE 196-500
2	Diaphragm Bolt	SOE 027-500
3	Diaphragm Nut	EJE 146-500
4	Diaphragm (2)	DIE 104-500
5	Center Body	SOE 808-500
6	O-Ring	ORE VIT-028
7	Toggle Cap, 100/250ppd	SOE 810-200
7	Toggle Cap, 500 ppd	SOE 812-500
8	10-24 x 11/4" Bolt	BTE STA 151
9	3/8" Tubing Connector, 100ppd	TCE 100-100
9	1/2" Tubing Connector, 250ppd	TCE 100-200
9	5/8" Tubing Connector, 500ppd	TCE 110-500
10	Spring Pivot	SOE 277-500
11	Spring	SPE 125-000
12	Pin Pivot	SOE 513-500
13	Pin	SOE 176-500
14	O-Ring (2)	ORE VIT-203
15	1/4-20 x 3/4" Bolt	BTE STA 189
16	End Body, 100 & 250 ppd	SOE 809-200
16	End Body, 500 ppd	SOE 811-500
17	Toggle Pin	SOE 168-500
18	Toggle Spindle	SOE 751-500
19	Valve Stud	SOE 028-500

Repair Kit: #KTE-100-SOM includes items 4, 6, 9, 14

AUTOMATIC SWITCHOVER MODULE

Emchior, Inc.	Series E4000/E2000
Ecometries.	Series A000/2000
Capital Controls	Series 480/201
Hydro Instruments.	Series 800/300

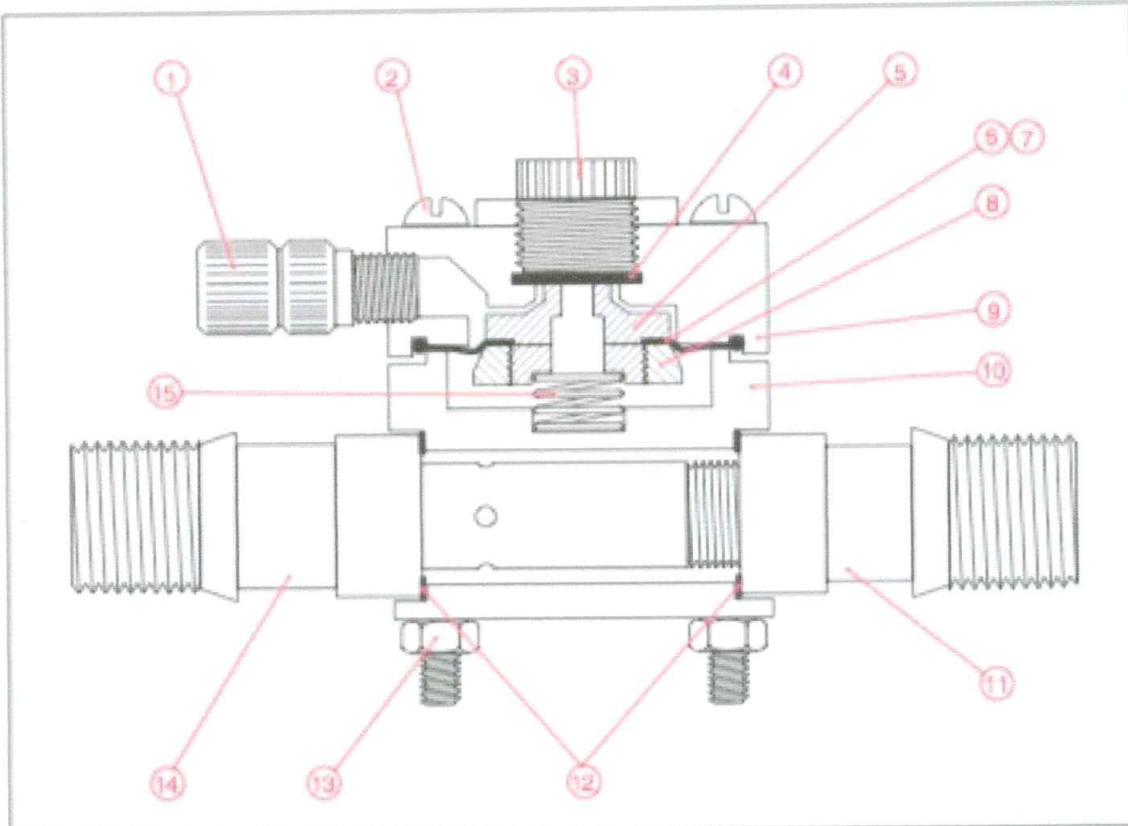


1	Rate Valve and Knob Assembly	RVE-665-100
2	Rate Valve Bonnet	RVE-349-100
3	O-Ring (2)	ORE-VIT-008
4	O-Ring (2)	ORE-VIT-112
5	Rate Valve Sleeve	RVE-350-100
6	Meter Gasket, 10 ppd max (2)	GAE-VIT-101
6	Meter Gasket, 25 ppd max (2)	GAE-VIT-102
6	Meter Gasket, 100 ppd max (2)	GAE-VIT-103
7	Remote Meter Panel	MPE-448-100
8	Meter Tube, 4 ppd max	MTE-108-004
8	Meter Tube, 10 ppd max	MTE-108-010
8	Meter Tube, 25 ppd max	MTE-108-025
8	Meter Tube, 50 ppd max	MTE-108-050
8	Meter Tube, 100 ppd max	MTE-108-100
9	3/8" Tubing Connector (2)	TCE-100-100

Repair Kit #KTE-100-RMP includes items 3,4,6 & 9

REMOTE METER PANEL: 100ppd max

Enchlor Inc.	Series E000
Ecometrics:	Series 4000
Capital Controls:	Series 480
Hydro Instruments:	Series 800



1	3/8" Tubing Connector	TCE-100-100
2	5/16 - 18 x 3 1/2" Bolt	BTE-STA-135
3	Seat Plug	EJE-311-200
4	Valve Seat	GAE-VIT-122
5	Diaphragm Bolt	EJE-206-200
6	Diaphragm	DIE-104-500
7	Support Diaphragm	DIE-105-500
8	Diaphragm Nut	EJE-146-500
9	Top Body	EJE-208-200
10	Bottom Body	EJE-153-500
11	Multi Purpose Diffuser	EJE-982-100
12	O-Ring	ORE-BUN-121
13	5/16 - 18 Nut	NTE-STA-104
14	Nozzle *	See Note
15	Spring	SPE-106-000

Repair Kit #KTE-100-EJS includes items 1,4,6,12

*Note: Available Nozzles:

CNE-016-106 (10 ppd max.)
 CNE-013-128 (25 ppd max.)
 CNE-015-156 (50 ppd max.)
 CNE-012-191 (100 ppd max.)

EJECTOR: 100ppd max capacity

Enchlor Inc. Series E4000/E2000
 Ecometrics: Series 4000/Series 2000
 Capital Controls: Series 480/Series 201
 Hydro Instruments: Series 800/Series 300

Nozzle Tables

10 PPD (200 gr/hr)

Nozzle >	16		13	
Ejector Backpressure	PSI	GPM	PSI	GPM
0	18	1.5	12	2.5
10	33	1.9	22	3.0
20	48	2.1	35	3.2
30	60	2.3	50	3.5
40	75	2.5	62	3.8
50	90	2.8	76	4.0
60	105	2.9	90	4.5
70	116	3.1	103	4.5
80	130	3.2	120	4.8
90	145	3.5	130	5.1
100	156	3.5	157	5.3
110	171	3.7	170	5.6
120	185	3.8	185	5.8
130	198	3.9	198	6.0
140	213	4.1	215	6.2
150	227	4.3	227	6.5
160	240	4.5	240	6.6

25 PPD (500 gr/hr)

Nozzle >	13		16	
Ejector Backpressure	PSI	GPM	PSI	GPM
0	25	3.0	40	1.9
10	35	3.2	60	2.2
20	47	3.4	80	2.5
30	60	3.7	100	2.9
40	73	4.0	120	3.2
50	90	4.3	140	3.5
60	100	4.5	160	3.6
70	115	4.7	180	3.8
80	130	4.9	200	4.0
90	145	5.2	220	4.2
100	155	5.3	240	4.7
110	170	5.5	260	4.6
120	185	5.7	280	4.8
130	198	5.9	300	5.1
140	212	6.1	-	-
150	226	6.3	-	-
160	240	6.5	-	-

Nozzle Tables

50 PPD (1 Kg/hr)

Nozzle >	15		12		13	
Ejector Backpressure	PSI	GPM	PSI	GPM	PSI	GPM
0	25	4.0	16	4.0	30	3.2
10	35	4.5	25	5.0	55	3.7
20	50	5.1	35	5.8	75	4.0
30	60	5.5	45	6.3	95	4.4
40	75	6.0	57	7.1	120	4.8
50	95	6.6	75	8.0	-	5.1
60	100	6.8	90	8.6	62	5.0
70	120	7.2	105	9.1	185	5.7
80	130	7.6	-	9.6	205	6.1
90	147	7.8	126	10.0	226	6.5
100	160	8.1	138	10.5	247	6.6
110	173	8.4	150	10.8	268	6.9
120	188	8.7	165	11.5	290	7.3
130	200	9.0	176	11.8	-	-
140	215	9.2	187	12.2	-	-
150	226	9.5	198	12.7	-	-
160	240	9.8	211	13.5	-	-

100 PPD (2 Kg/hr)

Nozzle >	12		15	
Ejector Backpressure	PSI	GPM	PSI	GPM
0	25	5.0	50	5.1
10	50	6.7	60	5.5
20	65	7.3	80	6.1
30	75	8.0	95	6.5
40	89	8.6	110	7.0
50	100	9.0	120	7.2
60	110	9.5	132	7.5
70	125	10.0	150	7.9
80	142	10.5	165	8.3
90	155	11.0	185	8.7
100	170	11.5	200	9.0
110	180	11.9	215	9.5
120	190	12.7	228	9.8
130	208	13.2	240	9.9
140	222	13.7	260	10.2
150	235	14.2	275	10.6
160	250	14.5	290	10.8