

# HYDAC<sup>®</sup>

## ***MODU-MAX***<sup>®</sup> COUNTER TIMER MANUAL



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will cover the "A"-size enclosure with transformer assembly), P/N 015142 one Counter-timer Controller Module, P/N 015192 and one 20 amp Relay Module, P/N 013320. "Add-on" modules such as Available Counter-timer Modules includes:

P/N 015142 - Full-size control module with capability to interface with add-on modules which offer additional features. P/N 015176 Full-size control module with a totalizing register to record water usage at the controller; capable of interfacing with add-on modules which offer additional features. P/N 2026351 - Basic Counter-timer in an "add-on"-size module. This module must be with at least one other control module for required power source.

#### ADDITIONAL EQUIPMENT/PARTS NEEDED FOR INSTALLATION

1. Water meter with electric contacting register. Order separately. See Water Meter Selection Chart for specifications.
2. Chemical pump - not supplied by Beta .
3. Cooling Tower application - see separate section titled "Expanded Service for Cooling Towers".
4. Boiler application - see separate section titled "Expanded Service for Boilers".

**FIGURE IX.**  
**WATER METER SELECTION CHART**

<u>Arad P/N *</u>	<u>Minimum Flow</u>	<u>Pipe Size</u>	<u>50% Max Flow</u>	<u>100% Max. Flow</u>	<u>Maximum Continuous Flow</u>	<u>Maximum Intermittent Flow</u>	<u>Gallons per contact</u>
028331	.1	3/4"	3	8	10	30	10
028334	.25	3/4"	3	8	15	40	10
028337	.25	1"	2.5	9	20	50	10
028340	.5	1-1/2"	3	9	35	100	100
028343	.5	2"	2.5	9	55	160	100

<u>Arad P/N *</u>	<u>Dimensions Length</u>	<u>Overall Width</u>	<u>Height (ref.)</u>
028331	12-1/2"	3-3/4"	4-3/4"
028334	14-1/4"	3-3/4"	4-3/4"
028340	16-1/2"	4-1/8"	4-3/4"
028340	17-3/4"	4-15/16"	6-1/4"
028343	18"	6-1/4"	7-11/16"

Pressure drop across meter psi

Meters supplied complete with threaded couplings.  
\* Larger sizes available upon request.

## INSTALLATION PREPARATION

FIGURE 1 SHOWS A TYPICAL INSTALLATION.

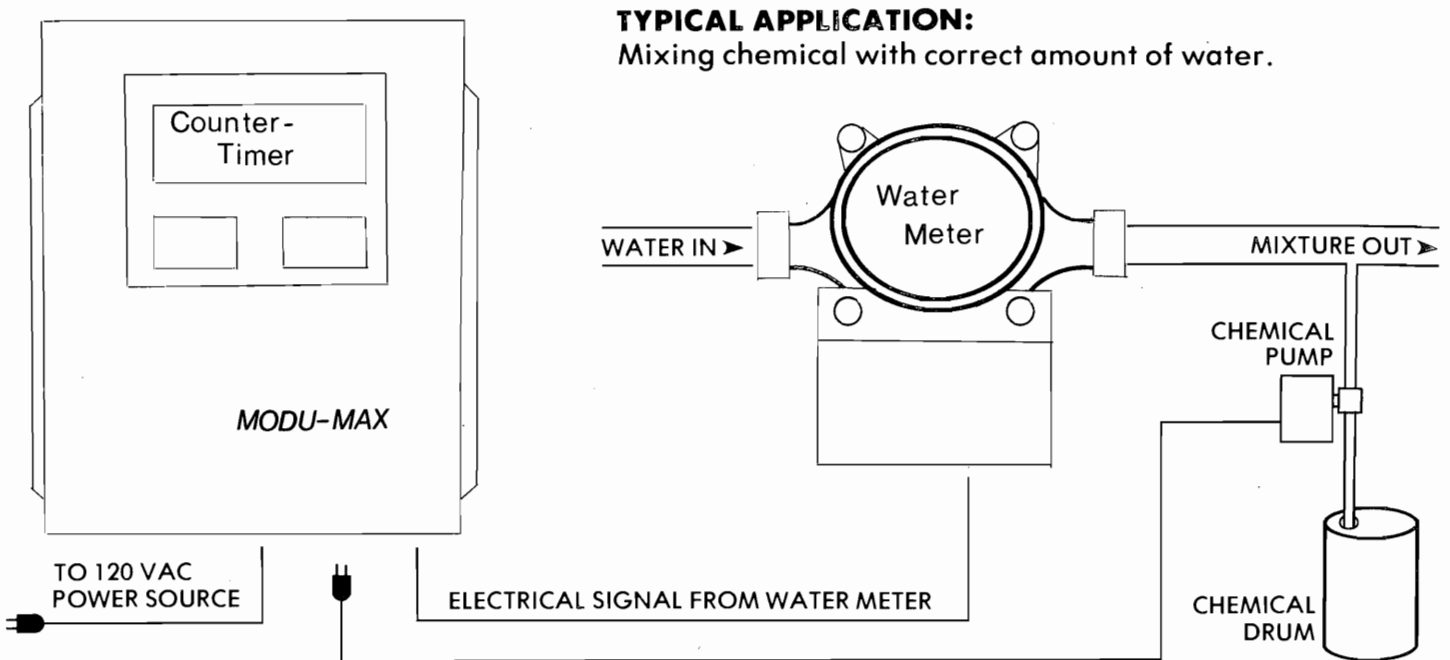


FIGURE 1.

Survey the make-up line configuration, ideally, the line will be near a floor and readily accessible for ease of water meter installation and periodic viewing of the water meter register to determine the amount of water usage. A comparison of water usage and chemical consumption indicates correctness of the dosage rate. If the water meter is mounted where it cannot be conveniently read, there is an available module with totalizing register, P/N 014792 to permit water usage to be read at the controller.

Make provision for a "by-pass" loop in the event that the water meter requires service, SEE FIGURE 11.

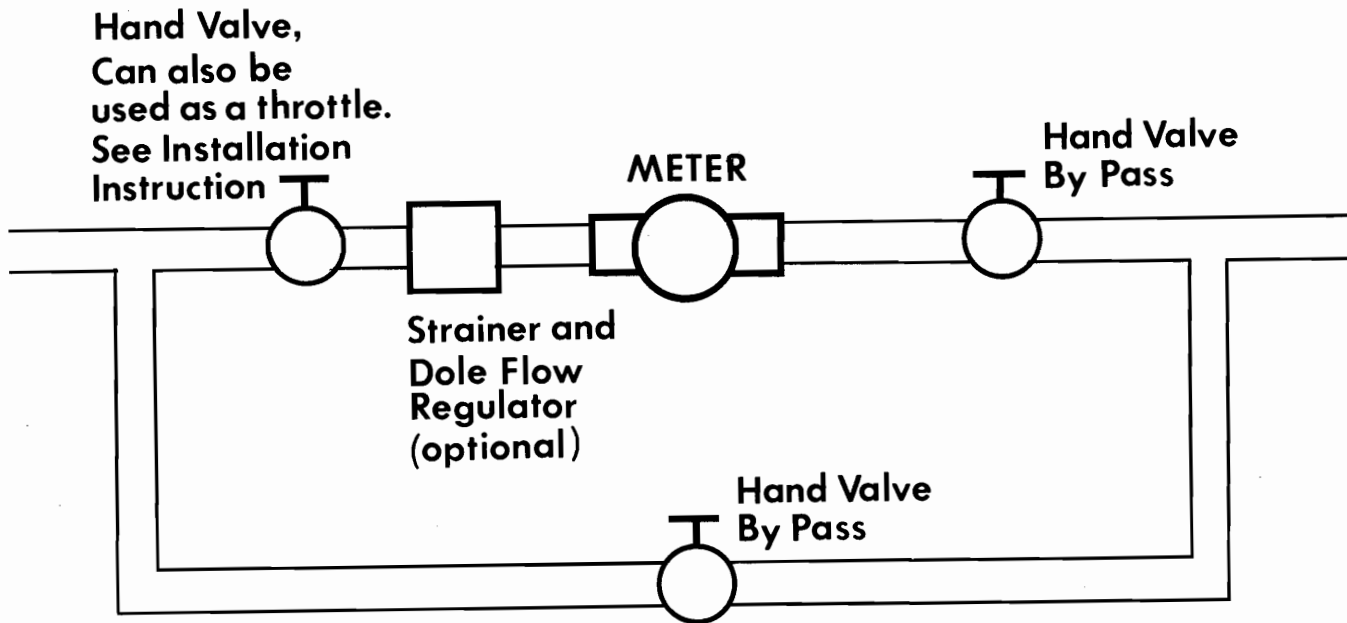


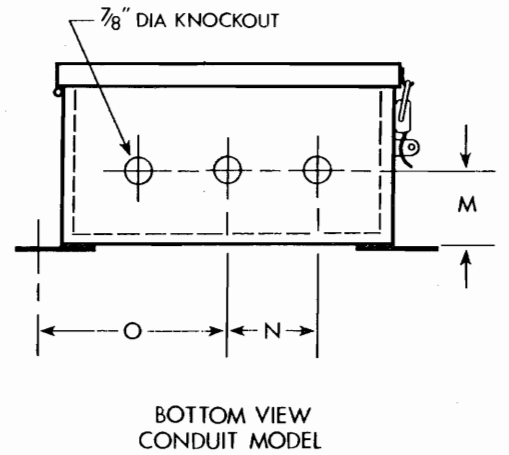
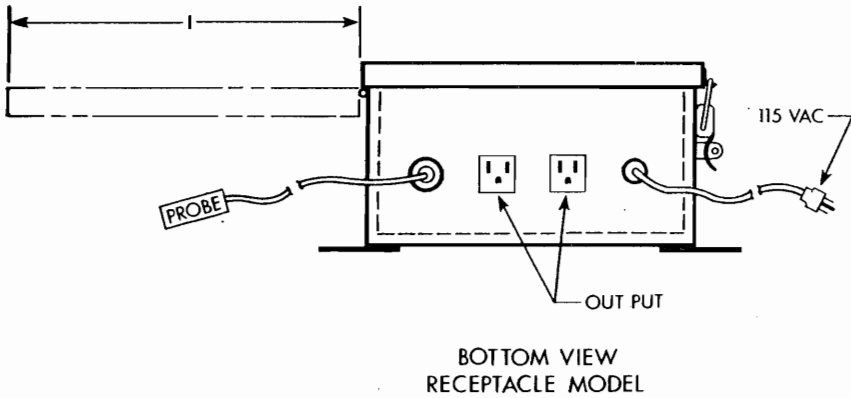
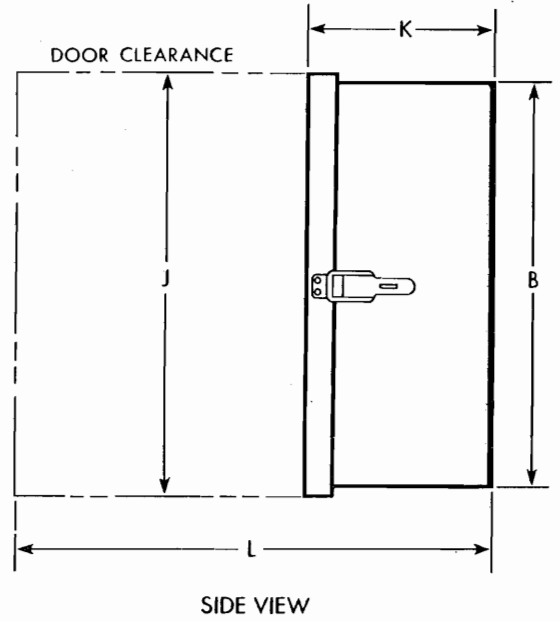
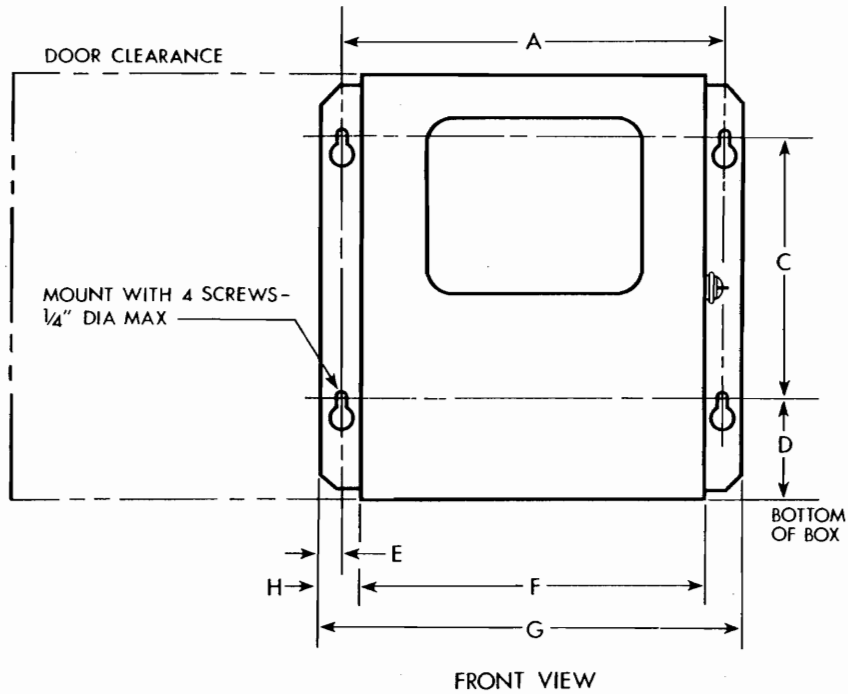
FIGURE 11.

This is a good time to size the water meter. A rule of thumb is to use the existing pipe size, although a more precise method of estimating flow rates is recommended. The text covers several applications (see Installation Section) and gives sizing criteria. Pump sizing is also covered.

#### MECHANICAL AND MOUNTING DIMENSIONS

SEE FIGURE 111

## MECHANICAL AND MOUNTING DIMENSIONS



A-size box	B-size box	C-size box
A=10-5/8"	A=13-3/4"	A=16-1/4"
B=11-3/8"	B=14"	B=17"
C=7-3/8"	C=10"	C=10"
D=2-17/32"	D=2-17/32"	D=4"
E=5/8"	E=5/8"	E=5/8"
F=9-3/4"	F=12-7/8"	F=15-3/8"
G=11-15/16" (max.)	G=15-1/32" (max.)	G=17-17/32"
H=1-5/32"	H=1-5/32"	H=1-5/32"
I=10" (max.)	I=13-1/8" (max.)	I=15-5/8"
J=12" (max.)	J=14-1/2" (max.)	J=17-1/2"
K=5-3/8" (max.)	K=5-3/8" (max.)	K=5-3/8"
L=14-1/4" (max.)	L=17-3/8" (max.)	L=19-7/8"
M=2-1/16"	M=2-3/16"	M=2-3/16"
N=2-1/16" (typ.)	N=3" (typ.)	N=3" (typ.)
O=5-5/16"	O=6-7/8"	O=8-1/8"

## INSTALLATION INSTRUCTIONS

### Controller:

The controller receives an electrical signal from the water meter and in turn energizes an electrical chemical pump in order to properly introduce chemical into the system.

Modu-Max is available with line cords and receptacles; however, for conduit installation observe the following:

Power wiring to the Controller should be 16 gauge or larger. The wiring to the water meter should be stranded, copper wire; 18-gauge is adequate, and is recommended for ease of wiring within the controller. All line voltage connections are made inside the connection box in the lower part of the controller. Be sure to replace cover before applying power to the controller. For personal safety, be sure to install ground wires.

The line voltage connections inside the connection box are shown schematically on FIGURE IV. FIGURE V shows the connection box with the cover removed. This figure also shows the routing of the water meter wiring along the left side of the connection box.

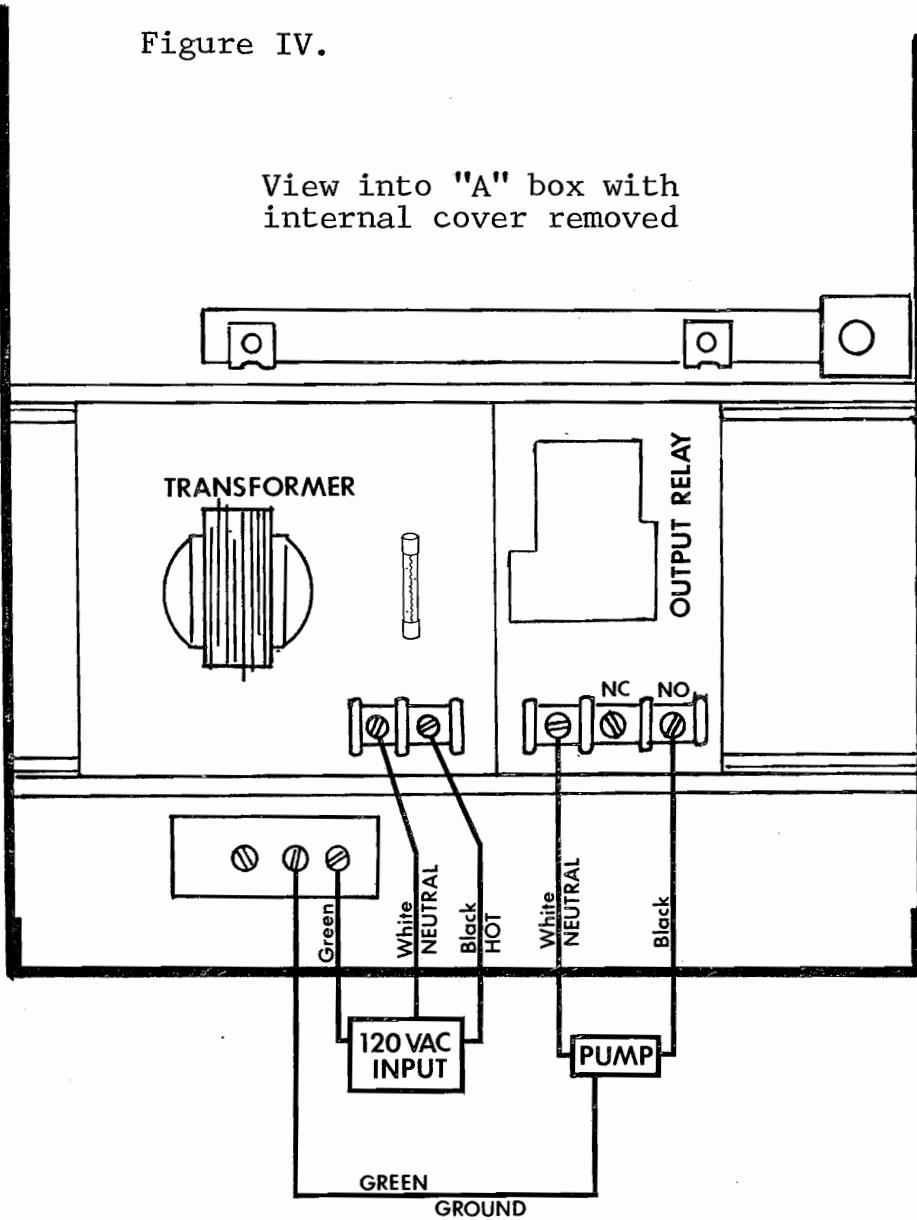
If the water meter wiring is run in conduit, it is important that no other wiring run in that conduit.

The controller should be installed as follows:

1. Mount the controller by means of the four holes in the

Figure IV.

View into "A" box with internal cover removed



Important - Output neutral is the same as input (connected together internally). All output relays switch "HOT" back and forth to the normally open and normally closed terminals. Relay de-energized, N/C is "HOT": Relay energized, N/O is "HOT".

Various Output Configurations

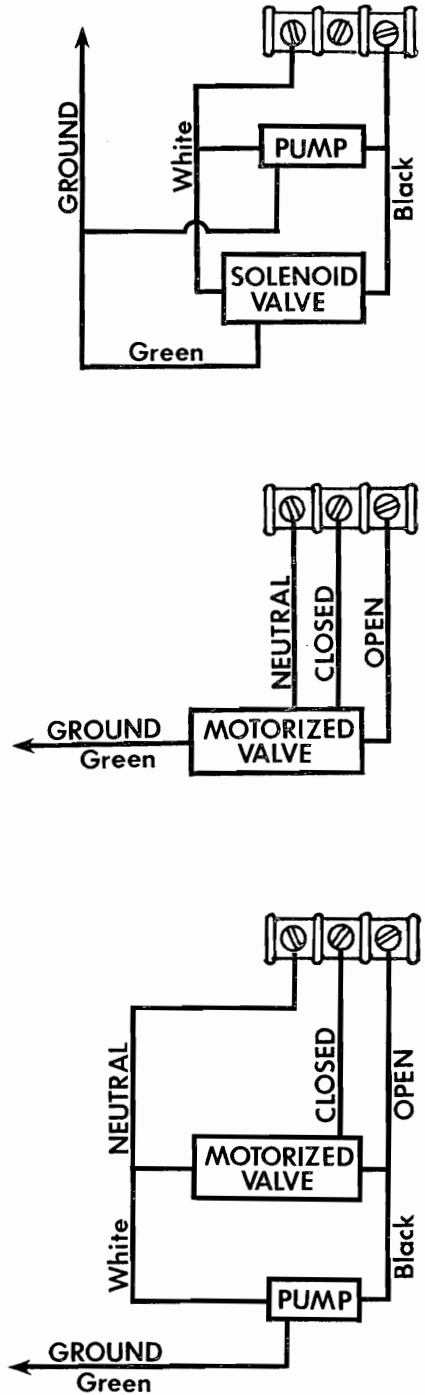
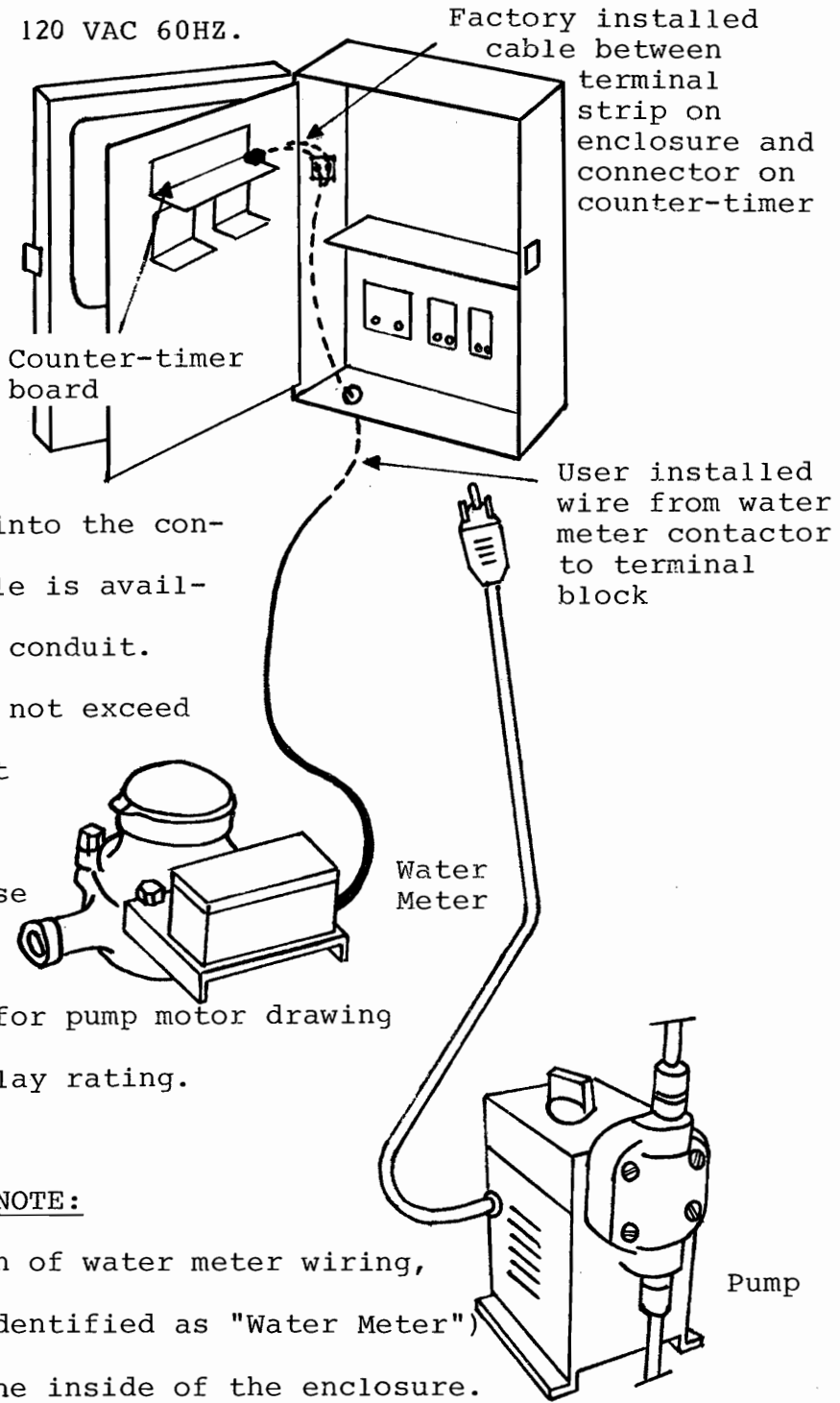


FIGURE V.

1. Input to controller 120 VAC 60HZ.

2. Circuit between controller and flow meter 24 VAC Class II. Wire size AWG #18 is adequate. Stranded wire is preferred.

3. Plug pump directly into the controller if receptacle is available; otherwise use conduit. This circuit should not exceed 20.0 amperes (Output relay, P/N 014792 ) maximum current. Use auxiliary motor starting contactor for pump motor drawing more than output relay rating.



IMPORTANT INSTALLATION NOTE:

To ease installation of water meter wiring, a terminal strip (identified as "Water Meter") has been added to the inside of the enclosure. Run electrical wires from the water meter contactor and the enclosure. Terminate this wire at the terminal strip provided. A factory installed cable runs from this terminal strip to the connector on the counter-timer board as shown in Figure VI.

mounting flanges in a location free of excessive heat, moisture, fumes, vibration and dirt.

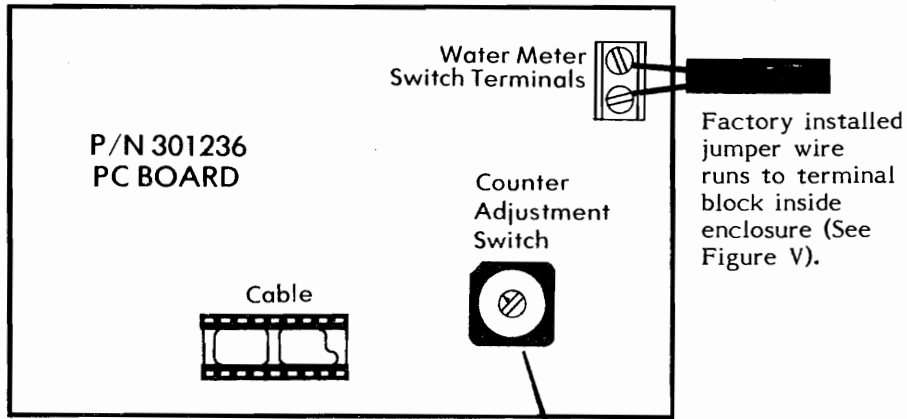
2. Run electrical wires between the water meter electrical connections and terminals on the inside of the enclosure identified as "Water Meter". This is low voltage wiring and need adhere only to the Class II Underwriter's regulations. Maximum current is less than 0.1 amperes.
3. Plug the service cord from the controller into the 115VAC-60Hz receptacle. For conduit models, a qualified electrician should install wiring.

#### Water Meter:

The water meter should be installed in the water line at a point where only water to be treated passes through the meter. Consideration should be given to winterizing the system in cold areas to prevent freezing of the unit. The meter and electrical circuitry is water resistant, but the unit should not be exposed directly to falling water.

The following steps should be adhered to when installing the meter:

1. Measure the length of the meter plus pipe couplings and make the necessary plumbing arrangements to accommodate the installation.
2. Install the couplings without the meter connected.
3. **IMPORTANT:** Thoroughly flush all lines before connecting the meter in the piping. Most meter difficulties are caused by foreign matter introduced into the piping



COUNT CODE  
SWITCH SETTING NO. COUNTS

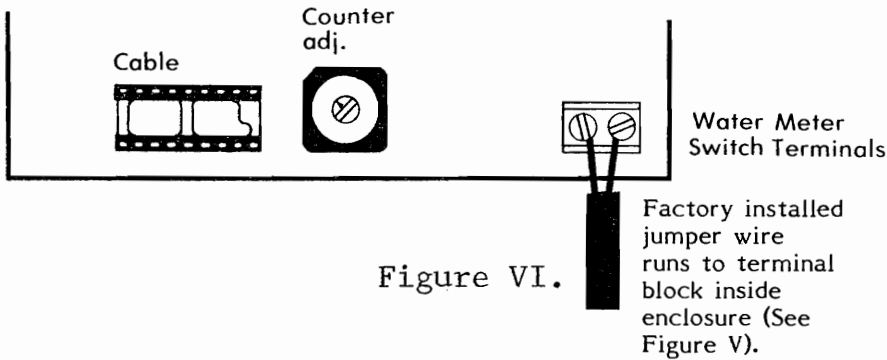
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
A	10
B	11
C	12
D	13
E	14
F	15
O	Timer stays off (always use 1 or more)

ENLARGED VIEW OF  
COUNTER ADJUSTMENT SWITCH



"ONE" Count SHOWN:  
Timer is activated on every  
water meter contact closure

Note-Model (P/N 015276) with totalizer has a difference PC board configuration



system in the form of pipe dope, threading chips, etc.

4. Connect meter to the couplings. Observe direction of flow indicated on meter.
5. Apply pressure to the system and check for leaks.

#### Chemical Pump:

Once the pump has been installed, it is necessary to properly adjust the pumping rate to obtain the desired chemical dosage of water. proceed as follows: (Note - A HyDAC measuring tube, P/N 025460, or equivalent is suggested).

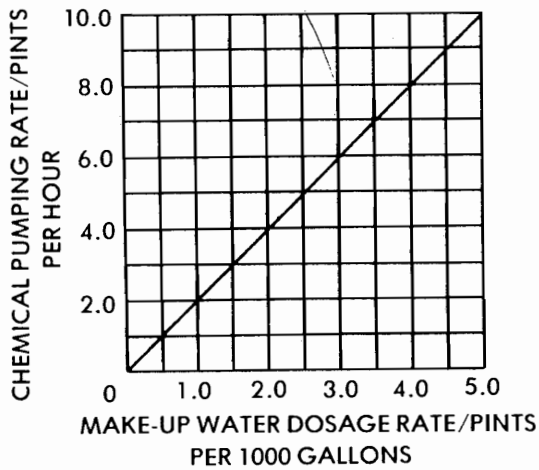
1. By referring to FIGURE VII, select the desired pumping rate in pints per hour that will give the required dosage in pints per thousand gallons. FIGURE VII is based on a timer setting of 18 seconds for 028331-Arab-30 gpm and 028334-Arab-40 gpm, 12 seconds for 028337-Arab-30 gpm and 50 seconds for 028340-Arab-100 gpm and 36 seconds for 028343-Arab-60 gpm. ADJUSTMENT OF TIMER: The timer adjustment potentiometer is located on the front of the control panel. Dial markings shown are only approximate. Use of a stop watch is suggested to set timer to desired value.
2. Obtain a convenient size container. Fill it with water and place the suction line of the pump in the water. Plug the pump into a 115 volt receptacle. The output of the pump should be connected to the system so that the measurement is made under actual operating conditions (pumping capacity decreases with increasing system pressure).

(pumping capacity decreases with increasing system pressure.)

3. Make sure that the pump is properly primed and check for air bubbles in the pumping head until all is purged from the head and suction line.
4. Fill the measuring tube with water and place suction line in tube. Make sure filter is all the way to the bottom of the tube.
5. Operate the pump at its maximum setting until the water drops to the start line on the measuring tube. Recheck to assure no air is in pumping head or suction line.
6. Adjust the pumping rate knob until the desired pumping capacity is obtained. The water system should be on and operating properly prior to making this adjustment.
8. When the desired pumping rate has been obtained, plug the pump into the receptacle in the bottom of the controller. Place the pump suction line in the chemical container.

FIGURE VII indicates the relationship between the water chemical dosage rate per thousand gallons and the pumping rate per hour of the chemical pump.

Figure VII

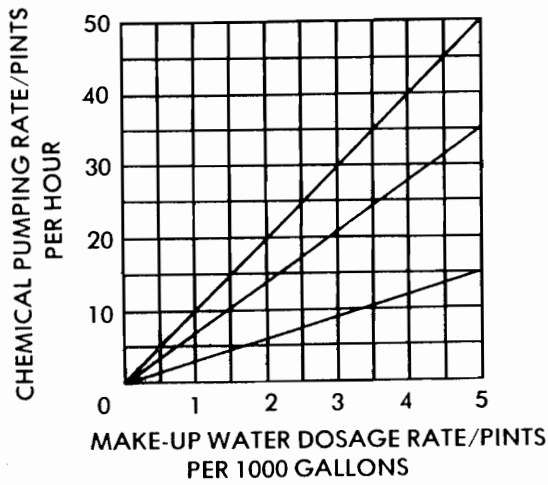


**WATER METER MODELS**

Arad - 028331 (30 gpm)

AND

Arad - 028334 (40 gpm)



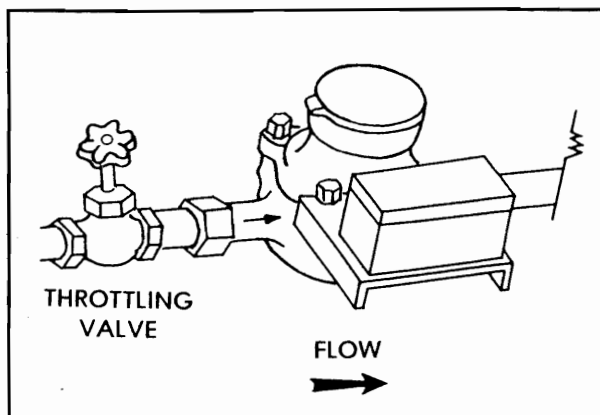
Arad - 028343 (160 gpm)

Arad - 028340 (100 gpm)

Arad - 028337 (100 gpm)

1. Determine desired dosage rate in pints per 1000 gallons of water.
2. Read chemical pumping rate/pints per hour.
3. Set chemical pump for this pumping rate. The HyDAC Feed Rate Measuring Tube, P/N 025460, can be used to confirm pumping rate,

FIGURE VIII



WATER METER WARNING

Temperature Rating:

Water flowing through meter must not exceed 100<sup>o</sup> F.

Hot water meters are available on special request.

Flow Rating:

See Figure VIII for correct directional flow through meter.

Pressure Rating:

150 psi Maximum

Dole Flow Regulator:

To prevent meter damage, use a Dole Flow Regulator or a hand valve in line with the water meter. SEE FIGURE VIII. As with the meter, flow direction must be observed when using a dole regulator.

DOLE FLOW REGULATOR TABLE

DOLE FLOW REGULATOR PART NUMBER w/ARAD	GPM RATING ARAD	PIPE SIZES INLET    OUTLET	DOLE FLOW RATING PRESSURE	WATER METER PART NO. ARAD
900887	10	1" F NPT    1" F NPT	15-125psi	028331
030160	15	1" F NPT    1" F NPT	15-125psi	028334
030278	20	1" F NPT    1" F NPT	15-125psi	028337
Use 1 (030278) & 1 (030160) in parallel for 35 GPM (Arad)				028340
Use 1 (030280) & 1 (030279) in parallel for 55 GPM (Arad)				028343

Strainer:

A strainer is also recommended to protect the water meter. Periodic cleaning of the strainer is mandatory because a water-starved system may cause HVAC equipment damage.

Water Meter Warranty:

The one-year water meter warranty is void if a meter is returned with foreign particles in the measuring chamber, or if the measuring chamber is damaged by excessive flow and/or hot water.

Check-Out Procedure:

- A. Visually inspect the controller for proper mounting and indication of any external damage.
- B. Press the TEST button and note that FEED light comes on and remains on for the selected time. If the counter is set for other than 1, you will have to press the TEST for the proper number of counts. SEE FIGURE VI.

- C. With water flowing through the meter, the counter should be activated once for every revolution of the water meter pointer (register). Check to see that the water meter operates properly with a flow of water and that the counter-timer responds to the signals from the contacting head on the meter.
- D. Disconnect the pump from the controller and plug it into 115 volts. Verify proper pumping rate. (Note: A feed rate measuring tube, HyDAC P/N 025460 or equivalent is suggested.)
- E. Plug pump back into the controller and activate controller with the TEST switch checking to be sure that the pump motor runs when the FEED light is on.

TROUBLE SHOOTING GUIDE

<u>Checkout Step</u>	<u>Symptom</u>	<u>Possible Cause</u>	<u>Remedy</u>
Step B	Feed light does not come on when test switch is pressed	Burned out feed light	Replace feed light, P/N 102700
		Counter set above 1	Depress the test switch the proper number of times
		Counter set at 0	Reset counter to at least one (1)
		Defective control board	Replace control board, see parts list for proper part number
	Feed light comes on when press-to-test switch is activated but goes off upon release of the switch	Defective control board	Replace control board, see parts list for proper part number
	Feed light ON time is not as desired	Timer setting has been moved	Reset timer
		Defective Timer	Replace control board, see parts list for proper part number
Step C	Water flows through meter but fails to turn pointer	Dirt in the water meter	Disassemble meter and inspect for cleanliness. Disassembly is achieved by loosening the bolts holding the top housing making sure that the small pipe connecting the housing to the electrical conduit box is not injured in the process. Remove and disassemble the measuring chamber contained in the lower housing. Carefully remove the oscillating piston, clean and reassemble.

Pointer on water meter turns but fails to activate the counter-timer

Defective wiring between water meter and controller

Remove electrical power from the controller. Disconnect one wire from the terminal strip in the water meter conduit box. Short this wire to the other wire and restore electrical power. If this activates controller, the wiring is satisfactory. Replace wire on terminal strip. This will have to be repeated if counter is set for other than one (1).

Defective meter contacting head

Replace meter contacting head or return complete meter to Cambridge Scientific Industries.

1-19-

Step D Pump fails to properly pump chemical

Refer to installation & maintenance manual for the pump

Step E Pump motor fails to run when treat light is on.

Defective socket in controller

Replace socket

Defective pump

Refer to installation and maintenance manual for the pump

Dirty relay contacts

Clean contacts

Defective control board

Replace control board

## EXPANDED SERVICE FOR COOLING TOWERS

In addition to adding chemical treatment to the cooling system, the Counter-Timer Control output may also be used to maintain a fixed level of dissolved solids (cycles of concentration) in the system. An electric bleed valve is actuated (opened) for the same time interval as the chemical feed pump. FIGURE IX shows a typical cooling tower installation.

### ADDITIONAL EQUIPMENT/PARTS NEEDED FOR INSTALLATION

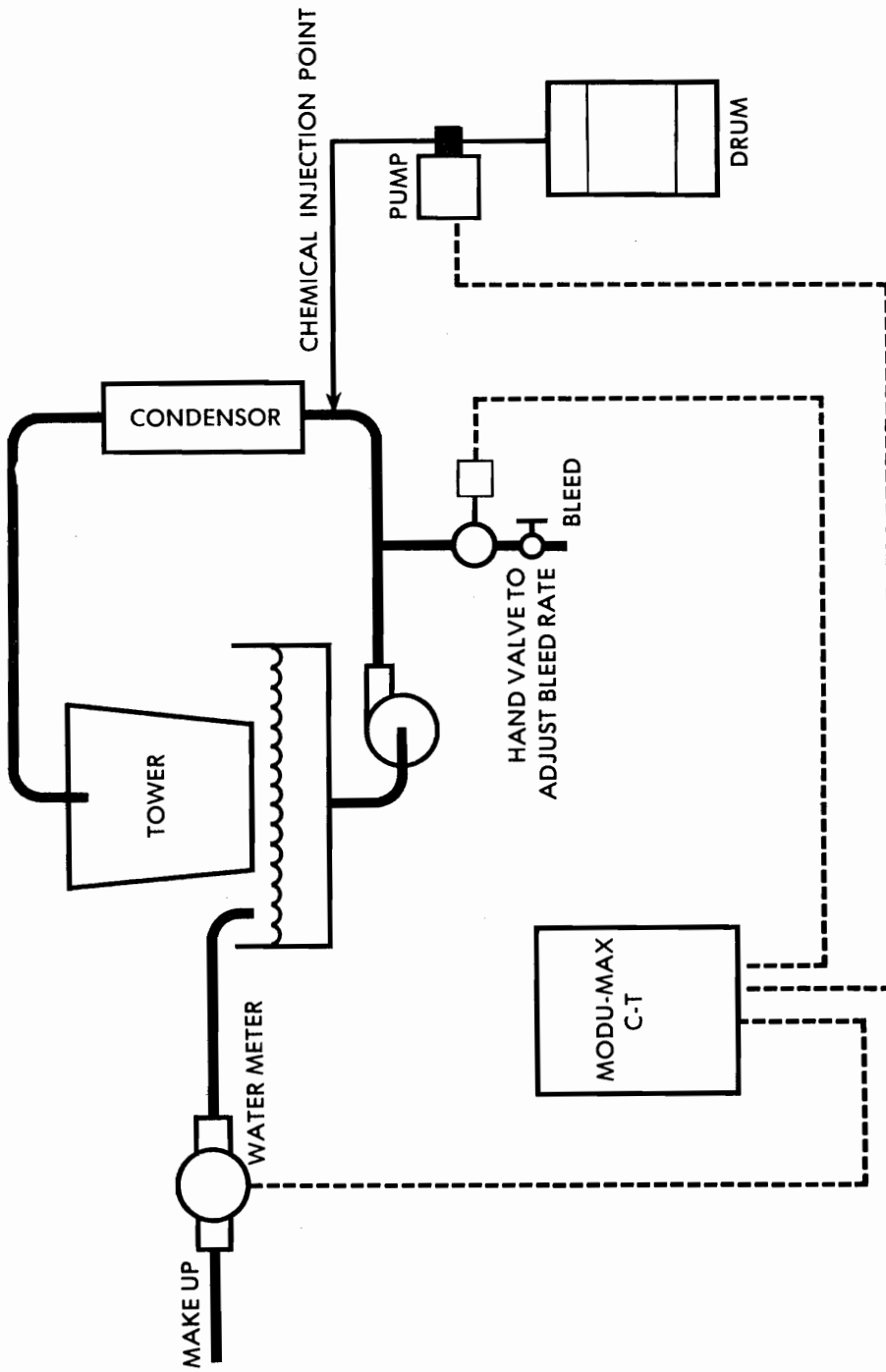
1. Hand valves - refer to FIGURES II and IX.
2. Select properly sized water meter - see Step 1 - "System Sizing".
3. Bleed valve - see Step 1 - "System Sizing".

Table 1  
 Contact factory for higher capacities  
 (Based on 100% Load & 3 Cycles of Concentration)

Water Meter Arad	P/N	Maximum Tonnage (Centrifugal and Reciprocating type Chillers) Arad	Maximum Tonnage (Absorption type Chillers)* Arad	Bleed Valve P/N**	Size
034676		200	100	028331	3/4"
034676		300	150	028334	3/4"
034676		600	300	028337	3/4"
030333		800	400	028340	1"
030491		1300	650	028343	1-1/2"

\*For technical information on Absorption ask for HyDAC Bulletin 010091

\*\*Note: Bleed valves require a minimum of 5 lb. water pressure to operate.  
 "Zero" pressure valves are available upon request.



TYPICAL INSTALLATION

Figure IX.

STEP 2 - Installation, see FIGURE IX.

See Installation Section for water meter, controller and chemical pump installation. To include bleed, simply tap in with a proper sized line on the discharge side of the main circulating pump. See FIGURE IX.

STEP 3 - Adjustment of Bleed Rate

The following formula shows the natural relationship between bleed, make-up and cycles of concentration:

$$\text{Bleed} = \frac{\text{Make-up}}{\text{Cycles of Concentration}}$$

Since Make-up is a constant 10 gallons (5/8", 3/4" and 1" water meters), you simply divide your desired cycles into the make-up to determine the portion of the make-up which must be bled.

TABLES 2 AND 3 ARE PROVIDED FOR CONVENIENCE.

TABLE 2

5/8", 3/4" and 1" water meters

<u>Cycles of Concentration</u>	<u>Gallons of bleed per timer operation</u>
2	5
3	3-1/3
4	2-1/2
5	2
6	1-2/3
7	1-1/2
8	1-1/4
9	1-1/10
10	1

The maximum timer operation (without counting) is:

18 seconds for 5/8" Arad water meter  
 13 seconds for 3/4" Arad water meter  
 12 seconds for 1" Arad water meter

TABLE 3

1-1/2" and 2" water meters

<u>Cycles of Concentration</u>	<u>Gallons of bleed per timer operation</u>
2	50
3	33-1/3
4	25
5	20
6	17
7	15
8	13
9	11
10	10

The maximum timer operation (without counting) is:

58 seconds for 1-1/2" Arad water meter  
 35 seconds for 2" Arad water meter

The actual bleed rate in GPM can be determined for any given situation. Example - a 300 ton centrifugal system requires a 3/4" water meter. For 3 cycles of concentration the chart indicates that you must bleed 3-1/3 gallons per timer operation. The maximum timer operation (without counting) is 18 seconds. Using a simple proportion:

$$\frac{18 \text{ seconds}}{60 \text{ seconds}} = \frac{3-1/3 \text{ gallons}}{\text{Bleed rate}} \quad \text{or Bleed rate} = \frac{3-1/3 \times 60}{18}$$

$$\text{Bleed rate} = \frac{200}{18} = 11.1 \text{ GPM}$$

This can be worked backwards to select a Dole Flow Regulator to control the bleed rate (optional-bleed rate can be controlled with a hand valve). Calculated bleed rate was 11.1 GPM.

Nearest Dole size is 12 GPM.

$$\frac{\text{Bleed Interval}}{60} = \frac{3-1/3}{12}$$

$$\text{Bleed Interval} = \frac{3-1/3 \times 60}{12} = \frac{200}{12} = 16.7 \text{ seconds}$$

Set timer to 17 seconds. Adjust chemical pump stroke accordingly.

#### STEP 4 - Checkout and Trouble Shooting.

Bleed should occur whenever the chemical pump is actuated.

If pump operates but no bleed occurs, check the solenoid valve.

## EXPANDED SERVICE FOR BOILERS

In addition to adding chemical treatment to the boiler, the counter-timer control output may be used to maintain a fixed level of dissolved solids (cycles of concentration) in the system. An electric blowdown valve is actuated (opened) for the same time interval as the chemical feed pump. FIGURE X SHOWS A TYPICAL BOILER INSTALLATION.

### ADDITIONAL EQUIPMENT/PARTS NEEDED FOR INSTALLATION

This section covers items which can be order initially with the basic Modu-Max controller. As with the "add-on" modules, separate instruction sheets apply.

1. Hand valve called for in the installation preparation section.
2. Electric valve assembly. A properly rated valve must be used (temperature and pressure). SEE FIGURE XI to determine rating.

Valves are available from **Beta** as follows:

Description	Pressure	Part No.
1/2" solenoid valve	125 WSP	027042
3/4" motor-operated valve	250 WSP	014792
3/4" electro pneumatic valve (20# to 150# air supply required)	600 WSP	015198

Note: Special valves are available on request

1. The hand valve is located between the boiler and the electric valve and should normally be fully open.
2. Connect the electric valve to the controller.
3. A throttling device should be installed to control the blowdown rate. Hydac recommends the orifice union kit, BETA P/N 015300. A "Hancock" type valve is also suitable. See Calculations and Graphs chart to determine the orifice size.
4. The water meter is installed in the boiler water make-up line. It measures the amount of make-up to the boiler and blows down the boiler accordingly. See Warning.

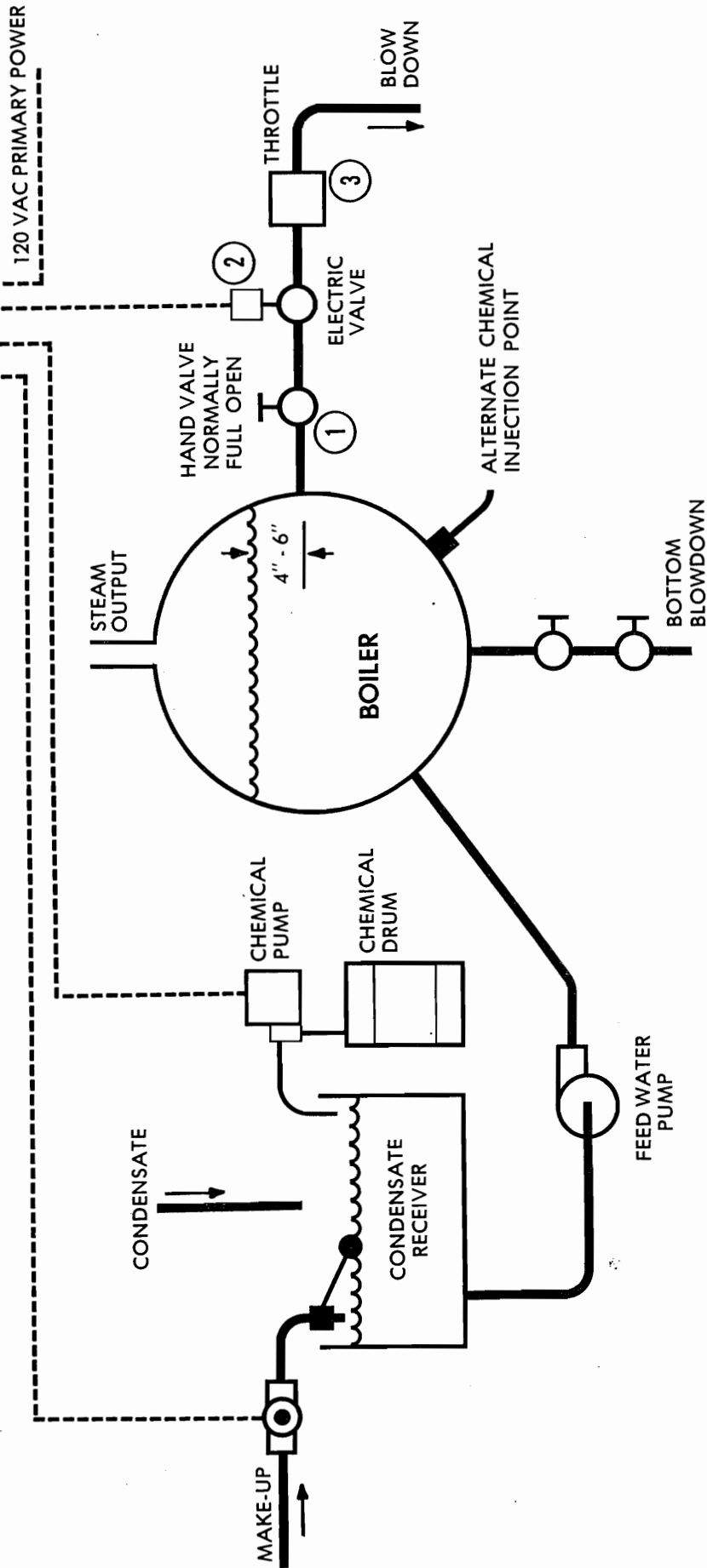


Figure X.

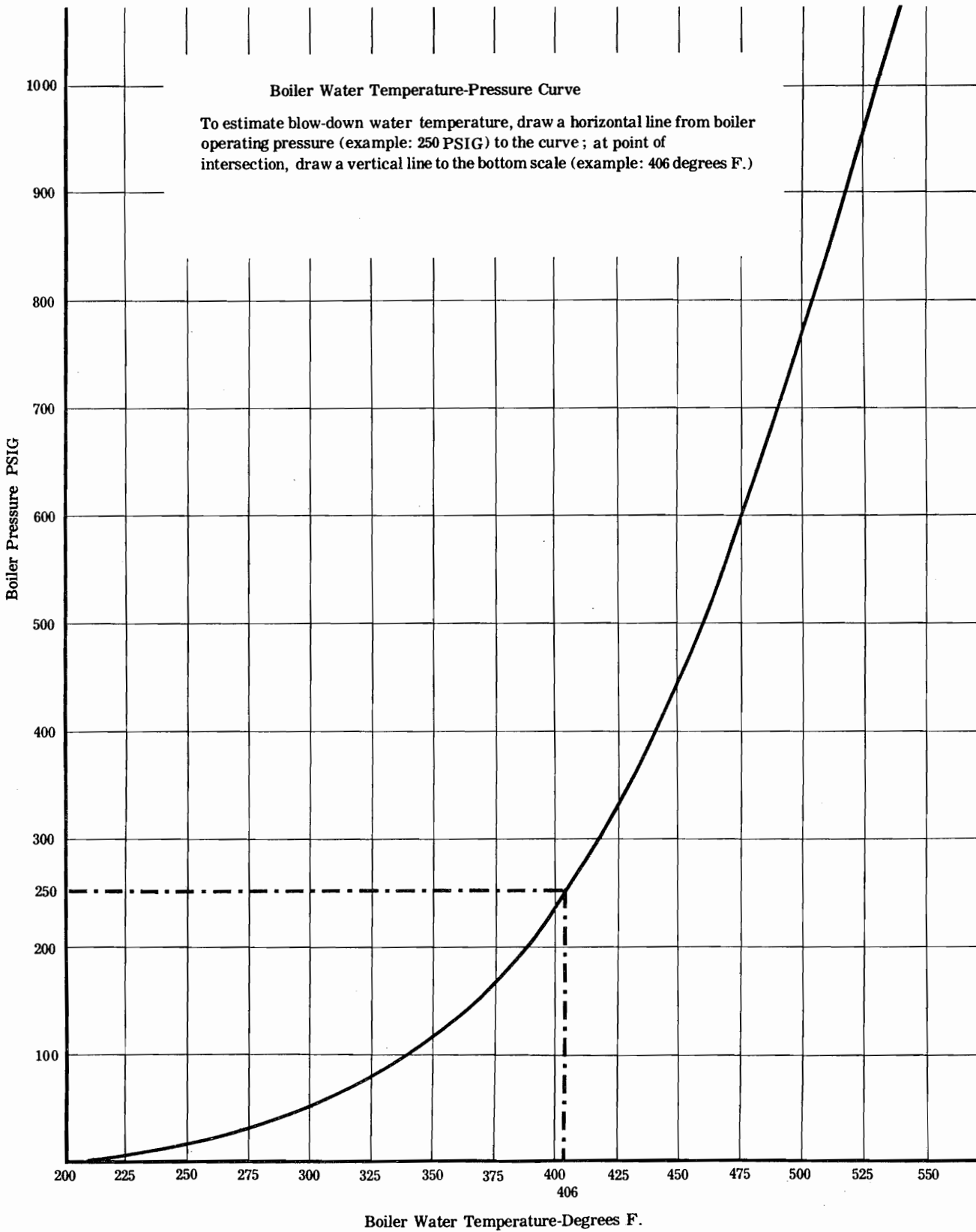
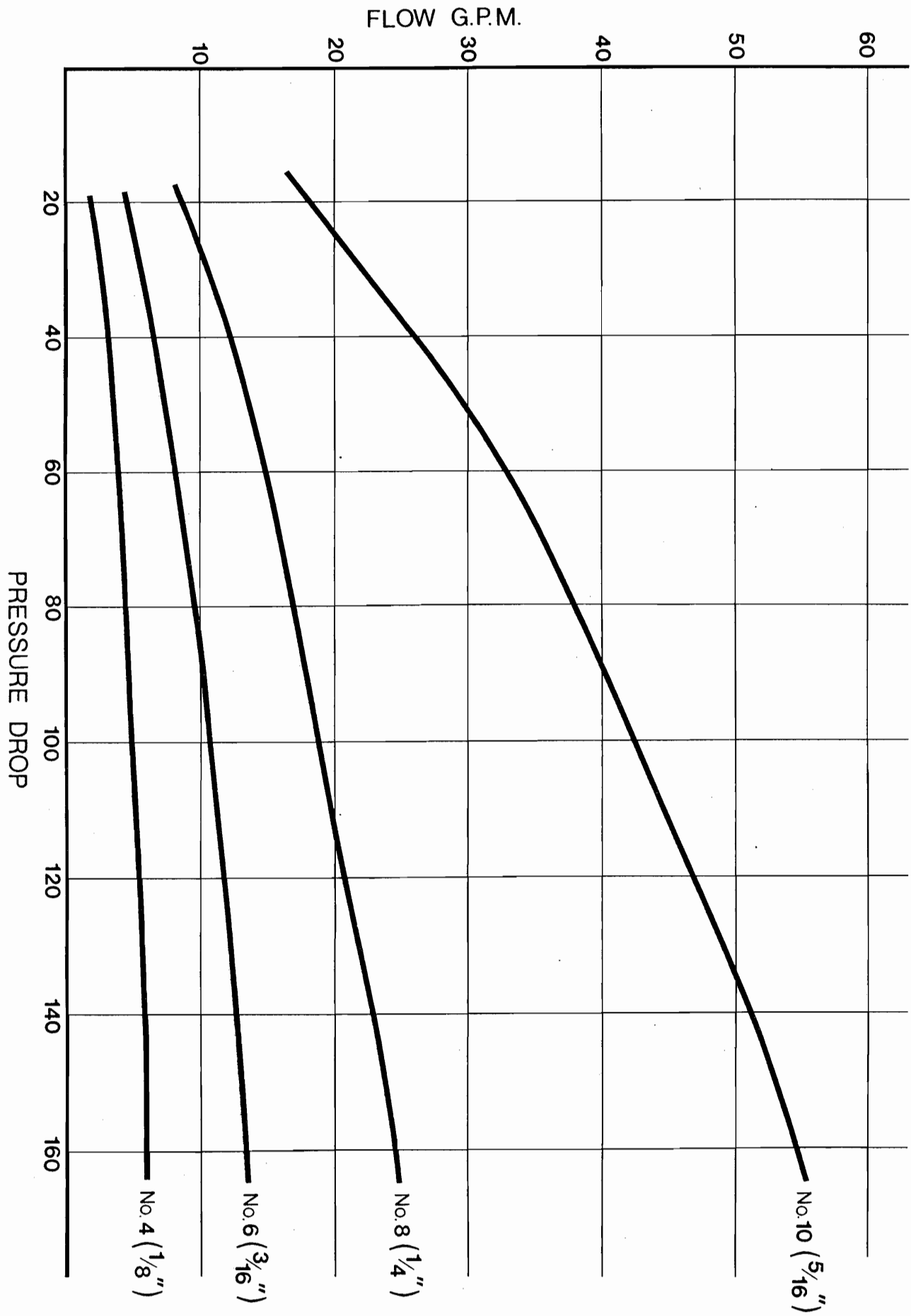


Figure XI.

# ORIFICE FLOW RATE VS. PRESSURE

Figure XII.



The orifice flow rate curves do not take into consideration the length of blowdown pipelines, pipe diameter or other variables such as back pressure created by flash tanks, heat exchangers, etc.

The curves should be used as follows:

### I. Calculate Blowdown Flow Rate

Step 1 – Calculate boiler make-up based on no condensate return

$$\frac{\text{Horse Power}}{15} = \text{Make-up in Gallons per minute}$$

or

$$\frac{\text{Pounds of Steam Per Hour}}{500} = \text{Make-up in Gallons per minute}$$

Step 2 – Determine if any condensate is being returned

$$\frac{\text{*Chlorides in the Feedwater} \times 100}{\text{**Chlorides in the Make-Up Water}} = \% \text{ Make-Up}$$

\*Obtain water sample from the condensate receiver

\*\*Obtain water sample from the water supply which maintains the water level in the condensate receiver

NOTE – Conductivity measurements may be substituted for Chloride residual measurements. If chemicals are being added to the condensate receiver, conductivity measurements will give erroneous results; use chloride test only.

Step 3 – Calculate actual Make-Up

$$\text{Worst Case (Step 1)} \times \frac{\% \text{ Make-Up (Step 2)}}{100} = \text{Actual make-Up in Gallons per minute}$$

Step 4 – Determine desired cycles of concentration. This is beyond the scope of this paper; however, 10 is typical with good quality make-up water (low calcium and magnesium content).

Step 5 – Calculate Blowdown Rate

$$\frac{\text{Make-Up (Step 3)}}{\text{Cycles of Concentration}} = \text{Blowdown Rate in Gallons per minute}$$

### EXAMPLE:

Step 1 –  $\frac{3000 \text{ Horse Power}}{15} = 200 \text{ Gallons per minute, Worst Case Make-Up}$

Step 2 –  $\frac{\text{Conductivity of Feedwater}}{\text{Conductivity of Make-Up}} = \frac{100}{300} = .33 \times 100 = 33\% \text{ Make-Up}$

Step 3 –  $200 \times \frac{33}{100} = 67 \text{ Gallons Per Minute Actual make-Up}$

Step 4 – Selected 10 cycles of concentration based on Water Treatment consultant's recommendation

Step 5 –  $\frac{67}{10} = 6.7 \text{ or } 7 \text{ Gallons per minute Blowdown}$

### II. Refer to the Orifice flow rate curves.

Step 1 – Determine Boiler operating pressure

Step 2 – Factor in blowdown rate from I. Step 5 (above)

Step 3 – Select the first orifice size which lies above the crossing lines (coordinates)

### EXAMPLE:

Step 1 – 150 PSIG

Step 2 – 7 Gallons per minute (from Step 5, Part I)

Step 3 – Select #6 (3/16") Orifice Plate

III. Try the Selected Plate for several days. If TDS slowly increases beyond the set point, go to next larger size orifice plate.

3. Throttle. A proper rated throttle must be installed downstream of the electric valve. BETA can supply an orifice kit with 4 plates; order P/N 015300. See FIGURE XII for plate selection. A Hancock-type valve can be used as an alternate means of throttling. Note: P/N 015300 is included with the 014792 and 015198 valve assemblies listed on page 25.
4. Strainer. If the solenoid valve is used, it is recommended that a strainer be installed upstream of the solenoid valve. BETA can supply a strainer rated at 125 WSP (compatible with valve P/N 027042). Order P/N 034669.

Chemical treatment can be accomplished by using the timer signal to actuate a small metering pump. This results in a proportionate chemical feed.

STEP 1 - System Sizing, See TABLE 4.

TABLE 4

(Based on 100% load, no condensate return & 10 cycles of concentration).

Water Meter P/N <u>Arad</u>	Maximum Horsepower <u>Arad</u>	Maximum Pounds of Steam per Hour <u>Arad</u>
028331	120	4000
028334	200	6500
028337	300	10000
028340	500	17000
028343	800	27000

Note: Larger water meters are available upon request.

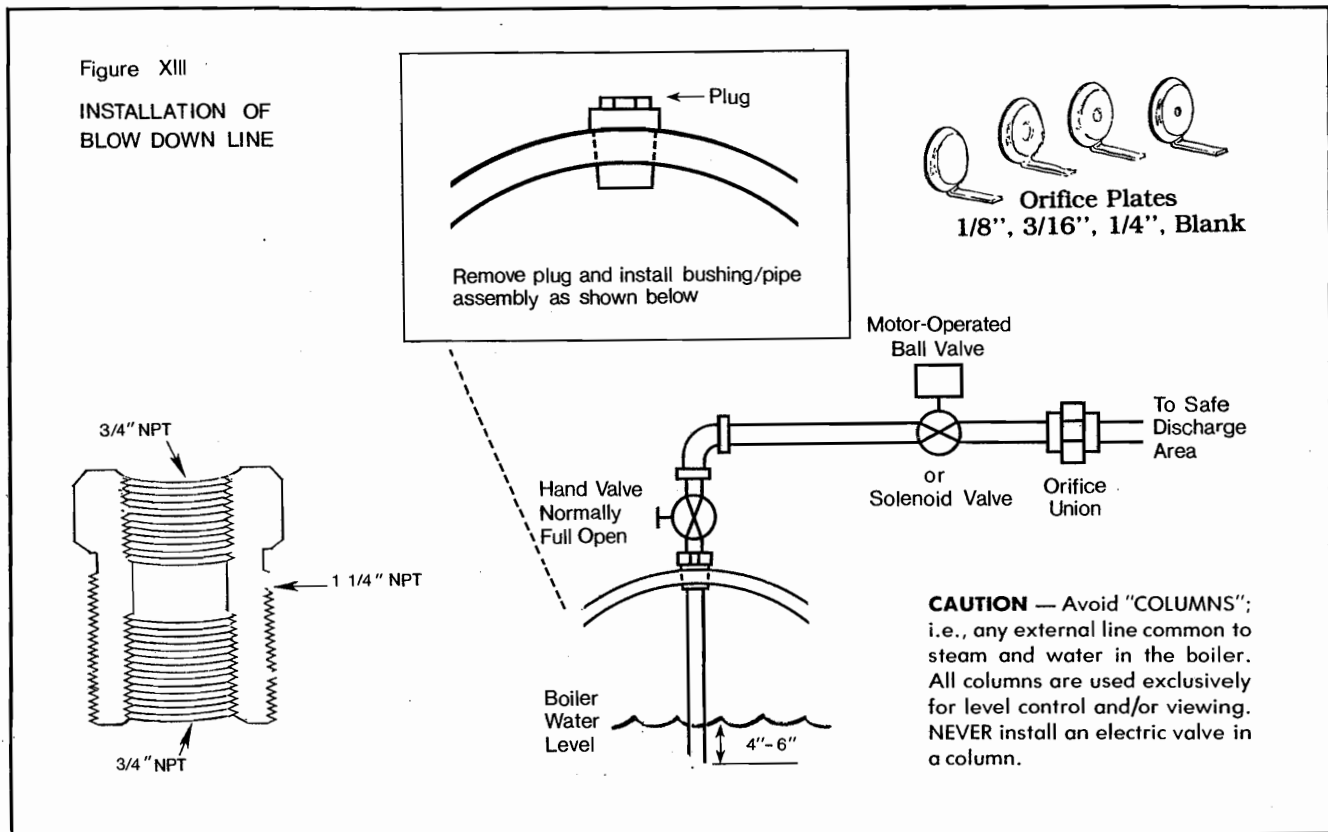
It should be pointed out that TABLE 4 is based on conservative calculations. Each individual situation should be analyzed and all operating parameters weighed before selecting a meter size.

**STEP 2 - Installation Preparation**

Survey the boiler; a suitable surface blowdown point should be located (typically 4-6 inches below the normal water level). If no line exists, see FIGURE XIII for a suggested method of installation.

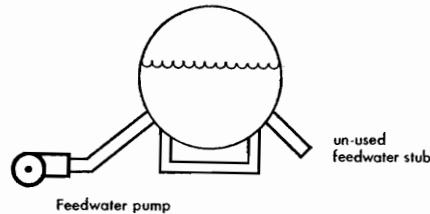
**CAUTION:** The surface blowdown line must discharge to a safe place (e.g. a flash tank).

Avoid a true "skimmer" blowdown line; these are sometimes found on old boilers. If you must use a skimmer line, it will have to be modified with a bushing and internal "dip-tube" to get below the surface of the water.



A column is used for level detection and control as well as visual observation of water level.

Feedwater points are usually too low (too far below the water level).



### Typical Boiler Feedwater Configuration

Whether it comes in from the side or the top of the boiler, the blowdown line must be 4-6 inches below the normal water level of the boiler. Wildly fluctuating water levels can result in steam entering the blowdown line. This will upset the make-up/blowdown balance and render the Modu-Max control system inoperative.

STEP 4 - How to use the orifice flow rate vs. pressure curves. You may use Tables 2 and 3 to determine the amount of blowdown required; however, you must "factor in" the timer setting. For example: The contact of a 5/8" water meter is 10 gallons. From the chart, a desired 10 cycles means that 1 gallon must be blown for every 10 gallons of make-up. Since we have a 5/8" or 20 gpm water meter, we have a maximum of 28 seconds in which to blow down 1 gallon. Use a simple proportion:

$$\frac{28}{60} = \frac{1}{\text{Blowdown rate}}$$

$$\text{Blowdown rate} = \frac{60}{28} = 2.14 \text{ or } 2$$

So the actual blowdown rate must be 2 gallons/minute. Now we go to the orifice flow rate chart to select the proper size orifice plate, FIGURE XII.

If the boiler operating pressure is 100 psi, the chart shows that the smallest orifice (1/8") in the HyDAC kit 015300 will pass 5 gpm. The example called for a 2 gpm blowdown rate.

The 1/8" orifice should be installed and cycles of concentration monitored. (See Operating Considerations below.) If adjustment is required there are two possibilities: change the orifice plate and/or change the timer setting.

If you change the timer setting, pumping rate should be changed accordingly.

Blank orifice plates are available from BETA in the event that hole smaller than 1/8" are desired. Order P/N 025454. Larger sizes than 1/8" are 4 included in the kit 015300: see FIGURE XII.

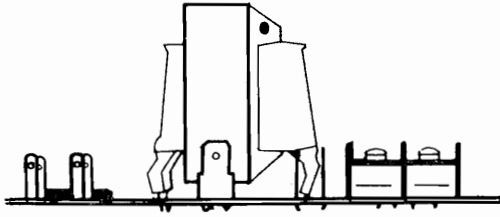
#### OPERATING CONSIDERATIONS

Any automatic system should be monitored periodically. A chloride test kit and/or a conductivity tester may be used for this purpose:

$$\text{Cycles of Concentration} = \frac{\text{Chlorides of Boiler Water}}{\text{Chlorides of Make-up Water}} *$$

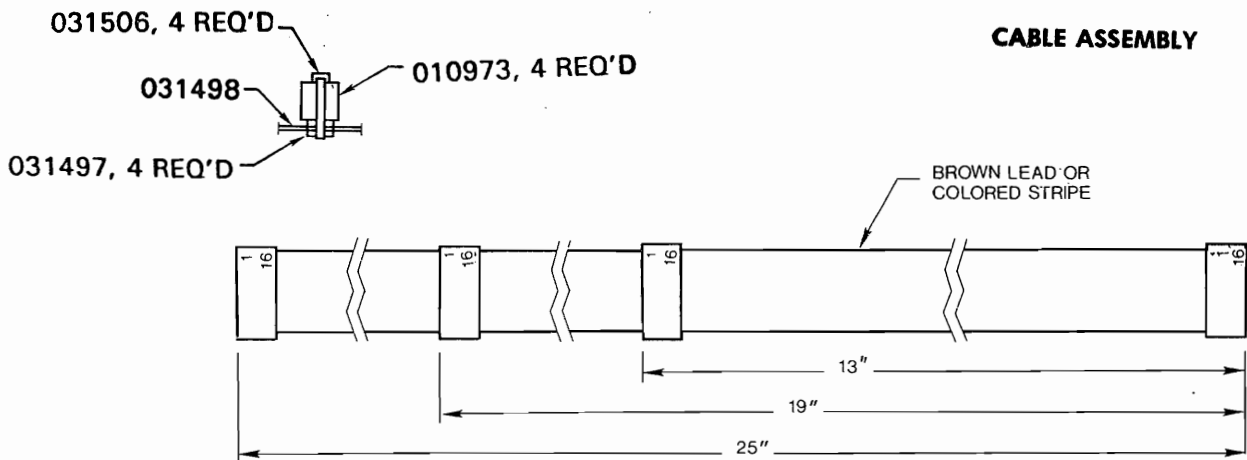
\*Not Chlorides of Feedwater

If conductivity is used, the boiler water must first be neutralized with gallic acid (or aspirin) hydrochloric acid or sulfuric acid. Phenolphthalein can be used as an indicator to tell when sufficient acid has been added.



**Transformer Assembly 013134**

**CABLE ASSEMBLY**



P/N 012921

## LIMITED TWENTY-FOUR MONTH WARRANTY

Beta Technology Incorporated ("BETA") warrants each new item of HyDAC brand equipment manufactured and sold by BETA to be free from defects in materials and workmanship under normal use and operation in accordance with "BETA" instructions and use directions for a period of twenty-four (24) months from date of delivery to the original purchaser. **Exception:** pH probes are only guaranteed to be operational at the time of delivery. All claims must be submitted in writing within 30 days from the date of shipment from BETA.

BETA's obligation under this warranty are limited to the repair or replacement of any such item of equipment (or part thereof) shown to be defective or, at BETA's option, to refunding the purchase price of any such defective item of equipment less a reasonable allowance for prior use. Each item of equipment for which a warranty claim is asserted shall, at the request of request of BETA, be returned on a prepaid basis to BETA's factory at the expense of the purchaser. Replacement parts furnished by BETA shall be warranted as stated above for the unexpired portion of the original twenty-four (24) month warranty. This does not extend to any item or part subjected to misuse, accident, improper installation, maintenance or application, improper packing by purchaser in return shipment to BETA, or to any item or part repaired or altered outside of BETA's factory without the express prior authorization of BETA.

THE FOREGOING WARRANTY IS IN LIEU OF ANY OTHER WARRANTY, EXPRESS OR IMPLIED, IN FACT OR IN LAW, INCLUDING WITHOUT LIMITATION THE WARRANTY OF MERCHANTABILITY OR THE WARRANTY OF FITNESS FOR PARTICULAR PURPOSE. IT IS EXPRESSLY UNDERSTOOD THAT PURCHASER'S SOLE AND EXCLUSIVE REMEDY IS LIMITED TO ENFORCEMENT OF BETA'S OBLIGATION AS SET FORTH ABOVE AND BETA SHALL NOT BE LIABLE TO PURCHASER OR OTHERS FOR LOSS OF USE OF THE EQUIPMENT OR FOR OTHER DIRECT, SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES.