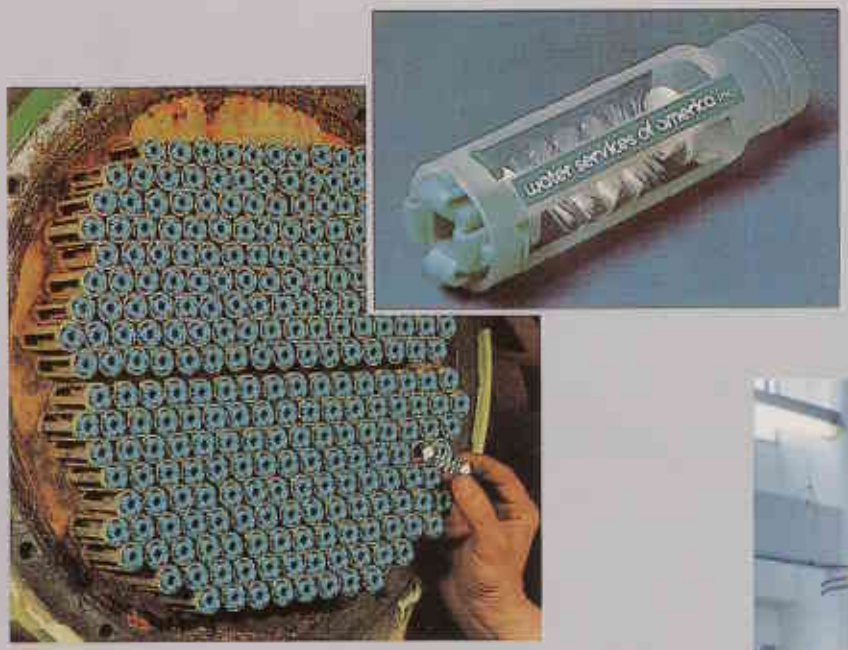


atcs

AUTOMATIC TUBE CLEANING SYSTEMS

Engineered Systems

P.O. Box 23848 • 8165 West Tower Ave.
Milwaukee, Wisconsin 53223-0848
(414) 354-6470 • FAX (414) 354-9007

INTRODUCTION

Condenser tube fouling can cost up to 30% extra in energy consumption alone, not to mention additional costs in chemicals, maintenance, and water. WSA has developed a new mechanical Automatic ON-LOAD Brush Tube Cleaning System for chiller condenser tubes that removes deposits and maintains a fouling factor that is much lower than that allowed for by chiller manufacturers. This improved fouling factor permits the chiller to operate at 100% of the rated capacity, and results in a 15% to 25% reduction in energy consumption for the average unit operating without the benefit of clean condenser tubes. In addition to the energy savings, there are less chemicals required when the tubes are kept clean. Elimination of the labor and downtime required for periodic shut-down, disassembly, and cleaning of the tubes also results in substantial savings.

The WSA Tube Cleaning System will automatically provide and maintain a fouling factor below manufacturers design specifications without any interruption in your operations. The system is simplicity itself. A special nylon brush is inserted in each tube, and a catch basket is attached to each end of the tube. A special WSA Internal "FUL-FLO" Diverter is installed to permit reversing the direction of the water flow in the chiller. When the flow direction is reversed, water pressure pushes the brush through the full length of the tube, removing deposits from inside the tube. The brush is caught in the basket, where it remains until the flow direction is reversed and the process is repeated. The frequency of the cleaning cycle will depend on the condition of the water being used.

The system has proven to be practical, dependable, efficient, and usually pays for itself in savings in 6 to 24 months.

BENEFITS

REDUCES ENERGY CONSUMPTION

Special testing has been conducted on both centrifugal and absorption type chillers of varying capacities and manufacturers. Significant reduction in the fouling factor by use of this system has consistently produced a reduction in energy consumption of 15% to 25%. As a result of these savings, the average installation will pay for itself in between 6 and 24 months. Savings are dependent upon the energy rates — in areas where rates are high, the savings are higher, and the pay-off period is reduced.

REDUCES MAINTENANCE COSTS

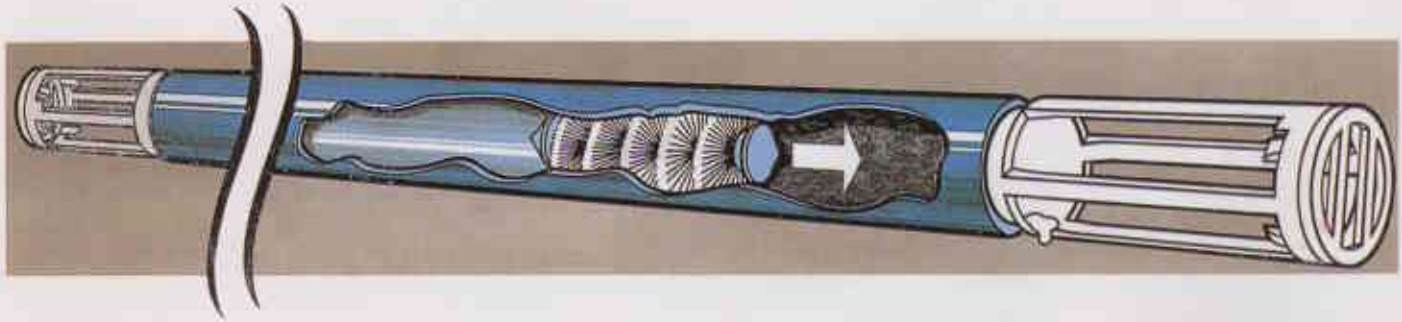
There is a significant saving realized with the elimination of the semi-annual shutdown of the chiller for disassembly and cleaning. All of the direct costs of labor, special brushes and chemicals, and the other indirect costs related to an interruption in the operation make tube cleaning a very costly procedure. Tests also show that without an ON-LOAD Tube Cleaning System, chiller efficiency begins to drop again as soon as the unit is put back into operation. Maintenance required to monitor and correct conditions caused by ever increasing tube fouling between cleanings is also eliminated by the ON-LOAD Tube Cleaning System.

REDUCES CHEMICAL CONSUMPTION

The ON-LOAD Tube Cleaning System does not eliminate the need for chemical feedwater treatment in cooling tower service. However, when the ON-LOAD Tube Cleaning System is used, the chemical treatment can be reduced because it is not required to prevent fouling of the condenser tube walls. With the ON-LOAD Tube Cleaning System chemicals are only used to protect the cooling tower and circulating pipe surfaces. Chemical requirements are less. The system also eliminates the need for chromates, which have been banned by most states, as an agent to inhibit corrosion. Non-polluting chromate substitutes can be used with the ON-LOAD Tube Cleaning System without increasing fouling in the tubes. There is also a direct savings by the elimination of the chemicals needed when tubes are manually cleaned.

REDUCES BLOWDOWN AND SAVES WATER AND SEWER CHARGES

With an ON-LOAD Tube Cleaning System it is usually practical to increase cooling tower water concentration thus reducing blowdown and cooling tower chemicals otherwise wasted to the sewer.



CONTENTS

THE SYSTEM

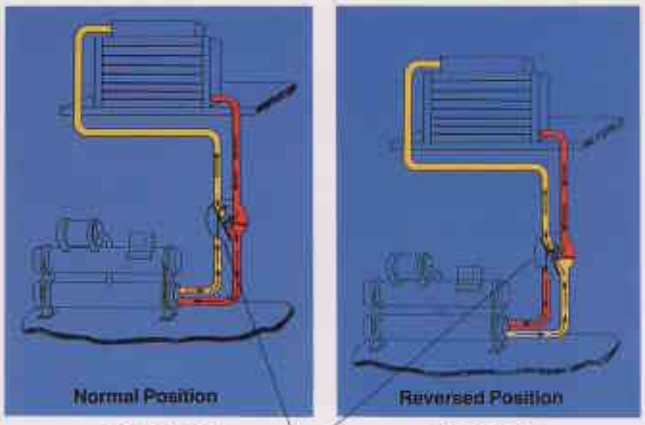


Figure 1 WSA 4 – Way Dir **Figure 2**

Figure 1 above shows a normal Flow condition of the condenser water. As the flow diverter is activated, the direction of the water flow in the condenser tubes is reversed, as shown in figure 2, and water pressure forces a brush through each tube in the condenser, removing any deposits on the tube walls. Every tube is scrubbed by a brush with each reversal of the water flow direction in the condenser tubes. This flow reversal is accomplished by a WSA Internal "FUL-FLO" Diverter. The cleaning cycle is completed without any discernible interruption of the functioning of the chiller — it is done completely "ON-LOAD". The complete WSA ON-LOAD Tube Cleaning System is a simple package of brushes, baskets, diverter and control panel that is fitted right into your existing chiller system with minimal modifications of your peripheral equipment.

BRUSH AND BASKET SETS

WSA brushes are available in sizes for tubes up to 1½ inches in diameter. They are constructed with nylon bristles and titanium wire core with polypropylene tips. They are inert and unaffected by condenser water conditions. The baskets are polypropylene and are bonded to the tubes with an epoxy type adhesive using a special tool. Each WSA basket is equipped with a removable end clip. This feature allows for removal and replacement of the basket end without damaging the basket, thus allowing the brush to be removed from the tube and passage of an eddy current test probe into the tubes. Brush life is excellent. Tests of brushes in service over five years show little wear or deterioration.

FLOW DIVERTER

The patented Internal "FUL-FLO" Diverter is unique — it provides internal flow transfer eliminating the 8 to 12 elbows required by a conventional valve. It takes much less space and has less pressure drop than conventional valve installations. Field installation costs are substantially reduced. WSA "FUL-FLO" Diverter can be used for any application which requires flow reversal.

Constant Clearances, Rotating Tube Design

WSA patented rotating tube diverters are steel welded design, constant clearance between the tube and body assure minimum bypass and low torque to actuate the plug. Multiple ring shaft packing can be replaced without disassembly of the diverter.

Bearing and Stem Seal

Bronze bearings prevent corrosion and assure lasting easy diverter operation without lubrication. Multiple ring shaft of packing and the packing gland are accessible without disassembly of the diverter.

Actuator

External double acting pneumatic actuator is standard. Requires supply pressure of 75 to 100 psig. Electric motor actuators can be furnished on special order.

Pressure Ratings

Non-shock working pressure ratings for standard WSA "FUL-FLO" Diverter is 150 psi. Higher pressure rating is available on special order.

Differential pressure rating across the diverter plug is 35 psig maximum.

Materials of Construction

Standard materials are steel housing and tube. Other materials are available on special order.

SAVINGS AND PAYBACK

Many factors contribute to savings and capital investment payback when a WSA ON-LOAD Tube Cleaning System is installed. These include but are not necessarily limited to chiller capacity, hours of operation, load factor, electric power cost, quality of cooling tower makeup water, local air quality conditions, number of times condenser tubes are cleaned each year, and the installed cost of the ON-LOAD Tube Cleaning System.

Experience has shown that minimum annual savings achieved by the use of the ON-LOAD Tube Cleaning System on a chiller of full load can be calculated using the following formula: Constant 0.15 x hours of chiller operation per year x rated chiller capacity x chiller rated kw/ton x electric power cost ($/kw)= Annual Dollar Savings.

As you can see, your energy savings can be substantial and once the initial cost is recovered, there is continuing return on your investment in the form of savings in energy, chemicals, and maintenance costs.

Discover how large your savings can be and how quickly an ON-LOAD Tube Cleaning System pays for itself by calling WSA ENGINEERED SYSTEMS.

SPECIFICATION

AUTOMATIC BRUSH TYPE TUBE CLEANING SYSTEM

GENERAL DESCRIPTION

An Automatic Tube Cleaning System shall be installed for each condenser/heat exchanger to maintain a fouling factor at or below 0.00025. The Automatic Tube Cleaning System shall be as manufactured by WSA Engineered Systems, Milwaukee, Wisconsin, or APPROVED EQUAL.

Tubes will be automatically brushed clean at preset intervals by two passes of each tube brush a minimum of every 24 hours. Cleaning is to be accomplished by means of a free-floating brush in each tube. The brush is contained in each tube by a basket located at both ends of each tube. A flow reversal diverter, (furnished as part of the system), is used to reverse flow inside the tube at a predetermined time while the condenser is on-line. The flow reversal propels the brushes through the tubes, thus cleaning them. A second flow reversal, several seconds later, returns the brushes back to their "park" position — again cleaning the tubes — until the next cycle.

EQUIPMENT SPECIFICATIONS

A. Brush and Basket Sets. One brush and basket set (one brush/two baskets with two end clips) is to be furnished for each tube. Brushes are to be made of nylon bristles, with titanium wire and polypropylene tips. Each basket assembly consists of a cage and a removable locking end clip (anti-vibration locking type), having a minimum of four (4) prongs. The end clip can be removed and reinserted into the basket without deformation to the basket. Baskets are to be made of polypropylene. The baskets are to be directly fastened to the tube end using special epoxy and able to withstand a 10 pound pull test. The baskets shall be designed so that, when attached to the tube, full access to the tube is provided by removing the end clip. This allows removal of the brush from the tube without deformation or removal of the basket cage from the tube.

The brush and basket sets shall be WSA as manufactured by WSA Engineered Systems, Milwaukee, Wisconsin or APPROVED EQUAL.

B. Flow Reversing Diverter. Each system shall be equipped with one "H" style diverter having integral connections that minimize field installation piping, labor and pressure drop. Diverter shall be of the rotating tube design with minimum clearance to minimize bypass. Diverters are designed and manufactured using the Boiler and Pressure Vessel Code, ASME Section VIII as a guide, for operation at a system working pressure of 150 psig with a maximum system feed to return pressure differential of 35 psig. Diverter shall be fabricated in an ASME approved shop. Diverters designed and manufactured in full compliance with Boiler and Pressure Vessel Code ASME Section VIII. ASME stamp on the diverter and material traceability documentation is available at additional cost. Each diverter shall be equipped with an electric or pneumatic actuator and position indicator per section D.

Diverter shall be heat treated, sandblasted clean and finish coated prior to shipment.

* ALTERNATE "In-head" flow diverter can be offered. The in-head diverter is housed in a custom designed waterbox channel which permanently replaces the regular channel box of the two pass condenser or heat exchanger.

C. Control Panel. The primary function of the control panel is to provide signals to the flow diverter actuator at preset time intervals.

The Control Panel shall include:

1. Timer to initiate cleaning cycle.
2. Manual override to start cleaning cycles.
3. "Power On" Indicator light.
4. Diverter position indicator lights.
5. Diverter cycle failure lights.
6. Cycle counter.
7. Flow switch bypass, with adjustable delay, optional if necessary.
8. Machine unloading, optional if necessary.
9. Control panel shall be NEMA 4X.
10. Underwriters Laboratory listed (UL APPROVED) — Control panel shall carry the UL label.
11. Digital set timers.
12. Easy future in-field addition of flow switch bypass and machine unloading features.
13. Dry contacts shall be provided for interface with building automation system and shall have the minimum functions as follow:
    - Power On Indication.
    - Remote Starting.
    - Remote Indication of Diverter Position.
    - Remote Cycle Failure Indication.
    - Remote Cycle Count.

D. Actuator and Position Indicator. Actuator shall be on electric motor driven bi-directional actuator which is operated on power supply of 230V/IPh/50Hz or a pneumatic double acting actuator operating on air pressure of minimum 40 psig.

A position indicator shall be provided for each diverter. The position indicator shall have limit switches in a NEMA 4 rated enclosure mounted on the diverter. The position indicator shall send signals to the control panel to indicate if and when the valve is in the normal or reverse position and advance the cycle counter.

QUALITY CONTROL

Inspection. Manufacturer should have an in-house inspection and quality control procedure established.

Shop Testing. Diverters shall be hydro tested in the manufacturer's plant at 1.5 times the design working pressure in accordance with ASME Unfired Pressure Vessel Code Specifications, Section VIII. Prior to shipment, the entire system shall be assembled and functionally tested (diverter, actuator, solenoid, position indicator and control panel). Fabrication and testing shall be opened for inspection by the owner or his designated agent.

FIELD SERVICE AND REPLACEMENT PARTS

The installation of brush and baskets, where allowed by local trade laws, will be performed by manufacturer. Manufacturer's qualified field service personnel are to be available at owners request and expense to service or repair equipment furnished after warranty period. Manufacturer shall maintain an adequate inventory of replacement parts at his facility available for immediate shipment.

EQUIPMENT WARRANTY

Manufacturer is to guarantee all system components, except brushes, to be free from defects in material and workmanship, for a period of one (1) year from date of shipment regardless of number of cycles. Brush life to be guaranteed for five (5) years from date of shipment based on manufacturer's recommendation of 1 cycle per 24 hours. Manufacturer's obligation under this warranty will be limited to repairing or replacing at manufacturer's factory any part which, within (1) year after shipment, and upon examination by manufacturer shall disclose to have been defective. Defective parts are to be returned freight prepaid, and will be replaced FOB from the Manufacturer's plant.

PERFORMANCE GUARANTEE

When the system is installed and operated in accordance with the instructions furnished by the manufacturer, the fouling factor in the condenser will be maintained at or below 0.00025.

CONDENSER CLEANING

Prior to installing the brush and basket sets, the condenser tubes shall be cleaned to the satisfaction of the manufacturer of the equipment. Chemical, mechanical cleaning or hydro-lance cleaning is typically required to remove any scale or fouling on the tube surface of existing machines. Prior to installing the basket cages, the tube ends must be free of any moisture, oil, grease or other contaminants.

DIVERTER

DESIGN AND CONSTRUCTION FEATURES

1. **Constant Clearance, Rotating Tube Design** — Internal seats are carbon steel standard (316SS optional) — constant clearance between tube and body seat assures smooth operation, minimum bypass and minimum actuator power.

2. **Bearing** — Oil impregnated bronze bearings prevent corrosion and galling while assuring lasting, easy operation without lubrication.

3. **Stem Seal** — Multiple "V"-ring packing provides excellent seal with minimum frictional load. Packing and packing gland are accessible and adjustable without disassembly of the diverter.

4. **100% Weld** — All components, including all internal baffles, are 100% welded from both sides. This assures that there are no open crevices or cracks for corrosion to begin.

5. **Actuator** — External, double acting pneumatic actuator is standard. Requires air supply pressure of minimum 40 psig. Spring return fail-safe pneumatic actuator and electric motor actuators can be furnished as special orders.

6. **Pressure Ratings** — Standard, non-shock working pressure rating is 150 psi. Higher working pressure available on special orders. Pressure drop at rated flow capacity for each diverter size is shown on page 19. Differential pressure rating across diverter plug is 35 psig maximum.

7. **Flexibility of Nozzle End Connections**

a Nozzle type — Plain ends are standard. Optional — beveled for field welding; grooved for Victaulic® Style 77 couplings.

Optional for extra cost — flanged, 150# raised-face

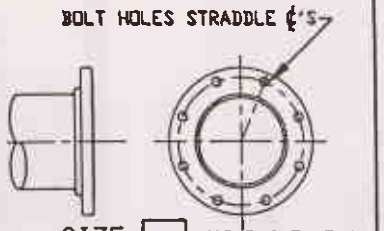
(flat-face or higher pressure rated flanges also available).

b Nozzle sizes — Nozzle pipe size can be varied or mixed where feasible — consult factory for specific requirements.

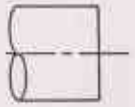
STANDARD MATERIALS OF CONSTRUCTION

- Body, tube and cover (bonnet) — SA36 carbon steel — PVQ steel, stainless steel or 90-10 copper-nickel available
- Packing gland — Cast bronze thru 16"

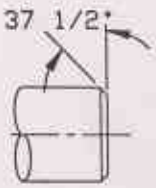
  — 304 SS 18" and above
- Packing — Homogenous Buna-N
- Packing Adapter Rings — Glass-filled nylon
- Bearings — Oil impregnated bronze



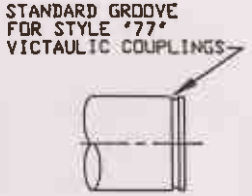
NFR RAISED FACE FLANGE



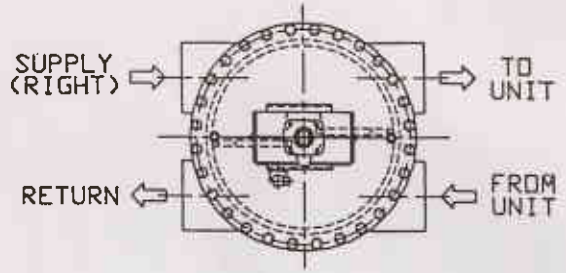
NP PLAIN END



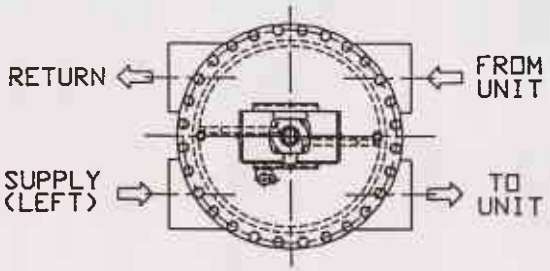
NB BEVELED END



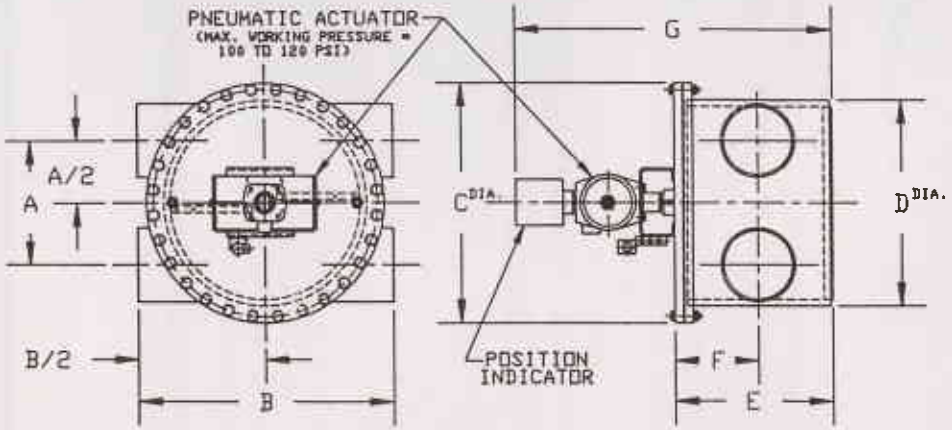
NG GROOVED END



SR SUPPLY RIGHT



SL SUPPLY LEFT



NOTE:
ALL DIMENSIONS SHOWN ARE IN INCHES AND ARE NOT AFFECTED BY ANY OPTIONS SHOWN ON THIS DRAWING. DIMENSIONS ARE SUBJECT TO CHANGE WITHOUT NOTICE.

SIZE	FLOW RATE (GPM - MAX.)	A	B	C	D	E	F	G
4"	400	10.00	21.00	21.00	18.00	10.00	6.00	27.00
6"	750	12.00	24.00	24.00	20.00	15.00	8.00	32.00
8"	1350	14.50	30.00	28.00	24.00	17.88	9.63	35.00
10"	2100	18.00	37.00	34.00	30.00	21.63	11.63	40.00
12"	3000	20.00	44.00	38.00	34.00	25.75	13.13	48.00
14"	3600	24.00	48.00	44.00	40.00	29.75	16.00	52.00
16"	4500	27.00	54.00	50.00	45.00	34.88	18.63	61.00
18"	6000	29.00	59.00	54.00	48.00	41.88	22.50	68.00
20"	7500	32.00	65.00	60.00	54.00	47.13	25.13	73.00

CUSTOMER NAME:

SITE LOCATION:

THIS DRAWING SUBMITTED FOR APPROVAL ONLY

APPROVED BY:
CHANGES:
DATE:

RETURN TO:
WSA ENGINEERED SYSTEMS
P.O. BOX 23848
MILWAUKEE, WI 53223

ORDERING INFORMATION (SELECTION)

NOZZLE END OPTION
SUPPLY LOCATION
SIZE
WSA NO. ☐ -S ☐ -N ☐

NO.	DESCRIPTION	BY	DATE
	REVISION		

	BY	DATE
DRAWN	DNB	7-11-13
APPROVED		

SCALE: NONE
DO NOT SCALE DRAWING

TOLERANCE UNLESS OTHERWISE NOTED
± 0.010 DECIMAL
± 1/16 FRACTION

PART NUMBER

WSA Engineered Systems
Milwaukee, Wisconsin—USA

PROFILE AND DIMENSIONS
MODEL LPDII IN-LINE FLOW DIVERTERS

DRAWING NUMBER	REV.	SHEET NUMBER
041-B-025	0	1 of 1

CONTROL PANEL

WSA MODEL 500 CONTROL

DESCRIPTION

The primary function of the control system is to control and monitor the Automatic Tube Cleaning System.

Options are available to send signals to the chiller control for unloading the machine during the cleaning cycle or bypassing a machine flow switch during the cleaning cycle.

BENEFITS

1. Four (4) control configurations to choose from.
2. Easy plug-in relay field modification for flow switch bypass or unload options if found necessary after installation.
3. Easy and accurate switch-setting of time delay relays.
4. Momentary actuation of MANUAL CYCLE, push-button for cleaning cycle.
5. Control panel, diverter and solenoid valve supplied separately to allow installation in a convenient locations.
6. NEMA 4X enclosure.
7. UL Listed, carrying UL label.

DESIGN AND CONSTRUCTION FEATURES

1. All controls include a position indicator switch mounted on the flow diverter, a solenoid operated four-way air valve with exhaust speed control mufflers (supplied separately) and a control panel.

A. **Position Indicator Switch** — Two cams and limit switches in a NEMA 4X cast aluminum and plastic housing mounted on the flow diverter. The switches send signals to the control panel which indicate the diverter position, advance the cycle counter, check the diverter operating time and generate the flow switch bypass signal.

B. **Solenoid Operated Four-Way Air Valve** — The solenoid receives an electrical signal from the control panel and sends an air signal to the actuator to change the diverter flow position. Exhaust speed control mufflers are adjusted so that a smooth transition in the water flow is maintained in the chiller during flow direction change.

For electrically actuated system, control panel will send signal to bi-directional motor on actuator to change the diverter flow position.

2. **Standard Features** (on the basic control panel, Model 500-0, and all other optional panels):

   A. NEMA 4X Enclosure (Fibreglass) — Indoor and outdoor use, for protection against rain, clean up water and corrosion.

   B. 24-hour Programmable Timer with 96 captive trippers which initiate the cleaning cycle at preset times.

   C. Indicator Lights for POWER ON, NORMAL FLOW, REVERSE FLOW and CYCLE FAILURE.

   D. Cycle Counter to record the number of complete cleaning cycles.

   E. MANUAL CYCLE push-button which allows a cleaning cycle to be initiated at any time; by depressing this button a system cleaning cycle will be completed and the control sequence will return to automatic operating conditions.

   F. FAILURE RESET push-button which turns the CYCLE FAILURE LIGHT off and also resets the cycle failure monitoring circuit. The CYCLE FAILURE monitor checks the time required for the flow diverter plug to change positions. If the actual diverter plug travel time exceeds the preset control time the CYCLE FAILURE LIGHT will illuminate. When illuminated a problem exists (i.e.: the diverter plug is stuck between flow positions or is taking an excess amount of time to travel between positions) and corrective action must be taken. The CYCLE FAILURE LIGHT will remain ON until the diverter plug is in the full normal or reverse position and the FAILURE RESET push-button is depressed.

   G. 120 Volt, 60 Hertz, 1 Ampere Panel Fuse.

   H. UL listed.

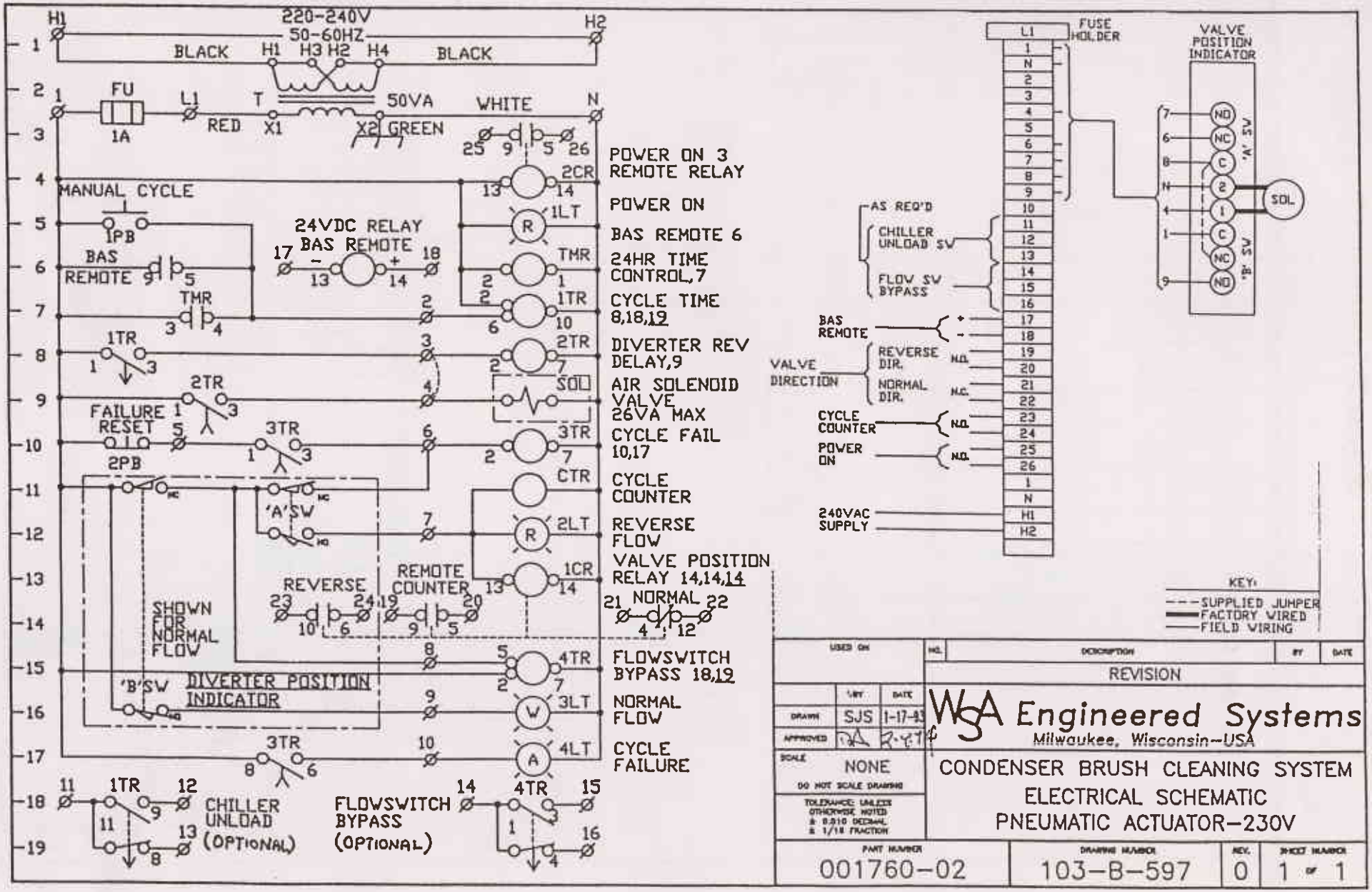
3. **Flow Switch Bypass Option** (Model 500-1): Some refrigeration units have a flow switch or a differential pressure switch which shuts the machine down if the flow in the condenser/evaporator water line drops below a specified rate. If installation of the flow diverter puts the flow switch between the diverter and the chiller, a control can be supplied to override the flow switch during the cleaning cycle and prevent shutdown of the refrigeration machine when the flow is changed. It is preferable to move the flow switch ahead of the flow diverter as this will maintain the machine low flow protection during the cleaning cycle.

   If the condenser/evaporator has a differential pressure shut down switch, the flow switch bypass control can be used to override the differential pressure switch during the cleaning cycle.

4. **Refrigeration Machine Unloading Option** (Model 500-2): Some refrigeration machines when operating at or near full load will shutdown on high head pressure when the water through the condenser/evaporator is reversed. This control option provides a signal to the refrigeration machine control to unload the machine before the diverter changes the water flow direction.

5. **Flow Switch Bypass and Unloading** (Model 500-3): Both options as described in 3 & 4 above are provided.

6. **Optionals**: Dry Contacts can be supplied to interface with building automation system for remote control and indications.


H1
220-240V
50-60HZ
H2
BLACK
H1 H3 H2 H4
BLACK
FU
1A
L1
T
50VA
WHITE
N
RED
X1
X2
GREEN
POWER ON 3
REMOTE RELAY
2CR
MANUAL CYCLE
1PB
POWER ON
1LT
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VALVE
26VA MAX
SOL
FAILURE
RESET
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2PB
CTR
CYCLE
COUNTER
'A'SW
2LT
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FLOW
REVERSE
REMOTE
COUNTER
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NORMAL
SHOWN
FOR
NORMAL
FLOW
4TR
FLOWSWITCH
BYPASS 18,12
'B'SW
DIVERTER POSITION
INDICATOR
3LT
NORMAL
FLOW
CYCLE
FAILURE
CHILLER
UNLOAD
(OPTIONAL)
FLOWSWITCH
BYPASS
(OPTIONAL)
AS REQ'D
CHILLER
UNLOAD SV
FLOW SV
BYPASS
BAS
REMOTE
VALVE
DIRECTION
REVERSE
DIR.
NORMAL
DIR.
CYCLE
COUNTER
POWER
ON
240VAC
SUPPLY
FUSE
HOLDER
VALVE
POSITION
INDICATOR
'A' SV
'B' SV
KEY:
SUPPLIED JUMPER
FACTORY WIRED
FIELD WIRING
USED ON
NO.
DESCRIPTION
BY
DATE
REVISION
DRAWN
SJS
1-17-
APPROVED
SCALE
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DO NOT SCALE DRAWING
WSA Engineered Systems
Milwaukee, Wisconsin-USA
CONDENSER BRUSH CLEANING SYSTEM
ELECTRICAL SCHEMATIC
PNEUMATIC ACTUATOR-230V
PART NUMBER
001760-02
DRAWING NUMBER
103-B-597
REV.
0
SHEET NUMBER
1 OF 1

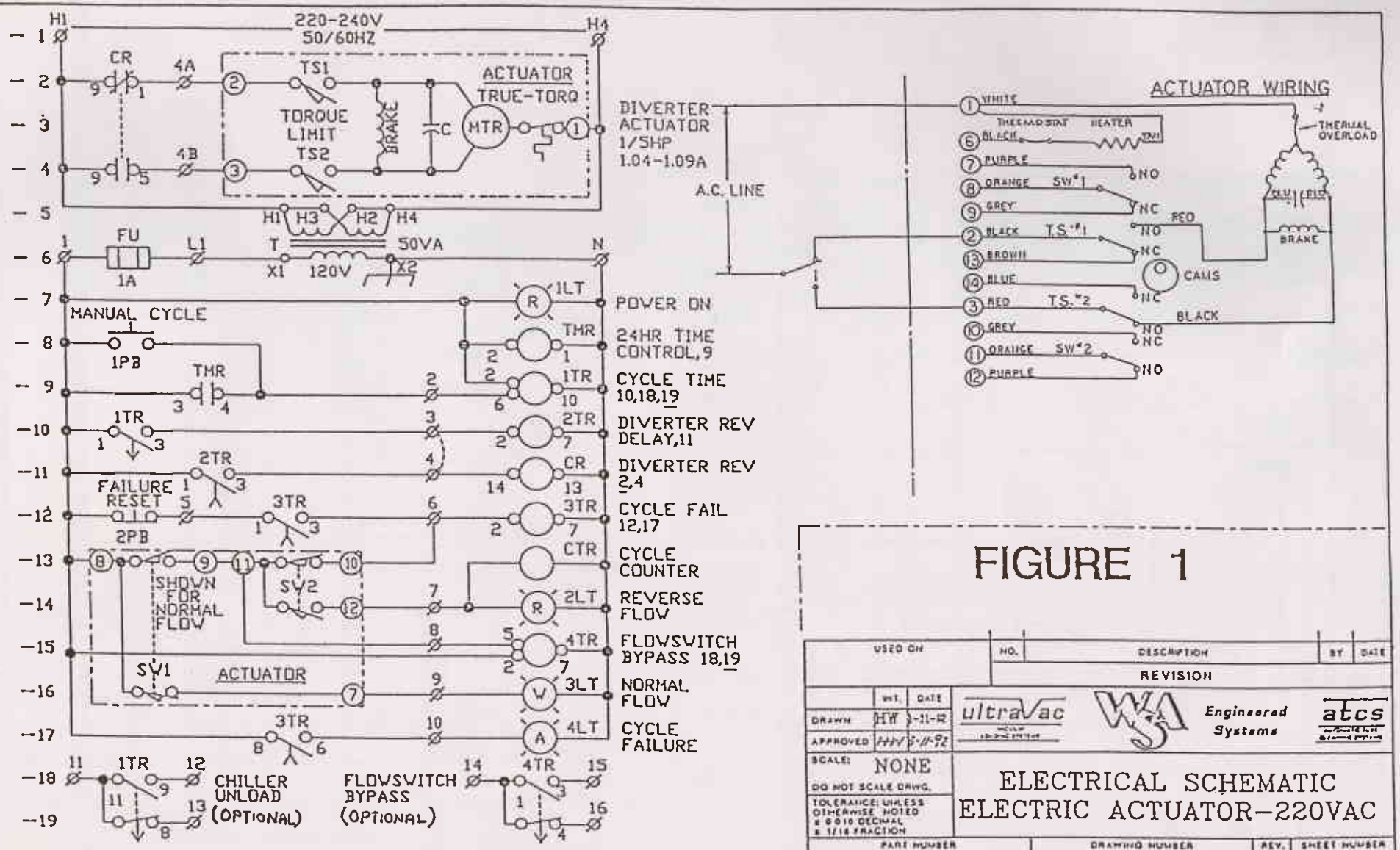


FIGURE 1

USED ON	NO.	DESCRIPTION	BY	DATE
		REVISION		

	INT.	DATE
DRAWN	HW	5-11-92
APPROVED		5-11-92

ultraVac — WJA Engineered Systems — atcs

SCALE: NONE
DO NOT SCALE DRWG.
TOLERANCE: UNLESS OTHERWISE NOTED ± 0.010 DECIMAL ± 1/16 FRACTION

ELECTRICAL SCHEMATIC ELECTRIC ACTUATOR–220VAC

PART NUMBER	DRAWING NUMBER	REV.	SHEET NUMBER
001587	103–B–575	0	1 OF 1

WSA BRUSH, BASKET AND END CLIP

BENEFITS OF THE WSA-DESIGNED BRUSH, BASKET AND END CLIP

- Variety of materials to suit most temperature and fluid compositions.
- Sizes to suit tubes 5/8" O.D. and larger.
- Removable locking end clip allows brush removal and passage of eddy current test probe through basket without need to deform or remove basket.
- Four-pronged end clip exerts even pressure on basket, eliminating eventual basket deformation and end clip loss.
- Anti-vibration tabs in basket window area eliminates end clip vibration that can cause early basket failure.
- Baskets available in either male or female versions to fit inside or over outside of tube end, respectively.
- Two methods of basket attachment: Direct epoxy or secondary tube sheet (described below).

BASKET ATTACHMENT METHODS

Standard for Normal and Medium Temperature — Direct epoxy of basket into (or over) tube end by use of a two-part epoxy adhesive. Fastened basket will withstand a 10 pound pull-test.

Optional for Normal and Medium Temperature — Factory assembly of basket to a secondary tube sheet. The secondary tube sheet has holes drilled to match the tube pattern of the condenser/heat exchanger tube sheet. Baskets are glued into each hole of the secondary tube sheet as described above, and the entire secondary tube sheet is bolted to the unit's tube sheet. This method allows the use of a basket with a slightly larger inside throat diameter. This reduces bristle interference in the basket throat, allowing the brush to shuttle at a lower fluid velocity. This method also allows easy brush replacement and access to tubes, lower installation cost and less down-time for system installation.

Standard for High Temperature — Metal Baskets are mounted in a metal secondary tube sheet. The tube sheet has holes drilled to match the tube pattern of the condenser/heat exchanger tube sheet. The entire secondary tube sheet is then bolted to the unit's tube sheet.

MATERIALS OF CONSTRUCTION

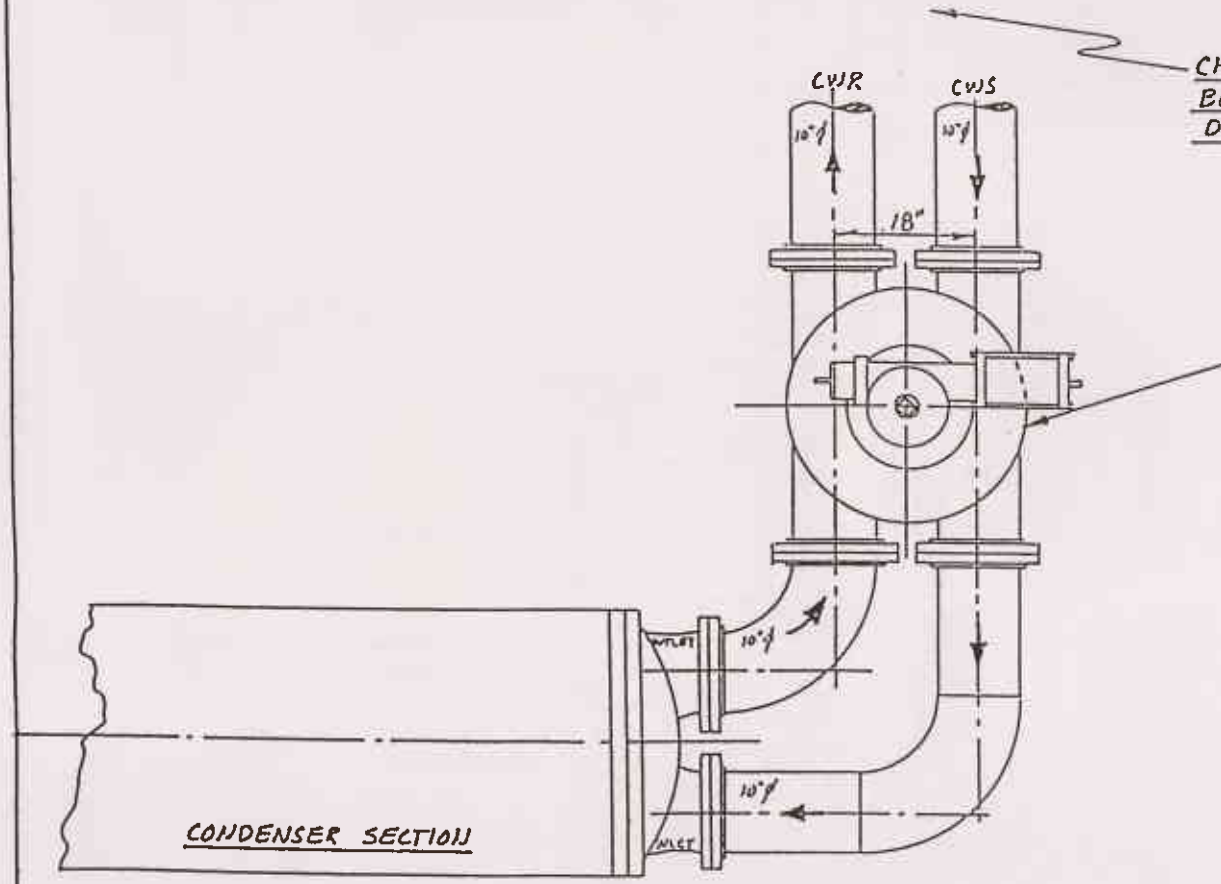
	Normal Temperature ≤ 160°F	Medium Temperature 160°F – 212°F	High Temperature ≥ 212°F
Brush Tip Stainless	Polypropylene	High Temp Polymer	316
Brush Bristle Stainless	Nylon	Special Polymer	316
Brush Wire Core Stainless	Titanium	Titanium	316
Basket Steel	Polypropylene	High Temp Polymer	*Carbon
End Clip	Polypropylene	High Temp Polymer	Stainless

* Stainless Steel Available

Brush

Basket and End Clip

Stainless Steel



CHILLER SHUT-OFF VALVES SHOULD BE UPSTREAM OF WSA FLOW DIVERTER.

10" WSA FUL-FLO IN-LINE FLOW DIVERTER WITH PNEUMATIC ACTUATOR. FLANGES SHOWN ON VALVE ARE SUPPLIED & FIELD WELDED BY OTHERS. FOR VALVE DIMENSIONS SEE PROFILE DWG. NO. 101-10B-M2.

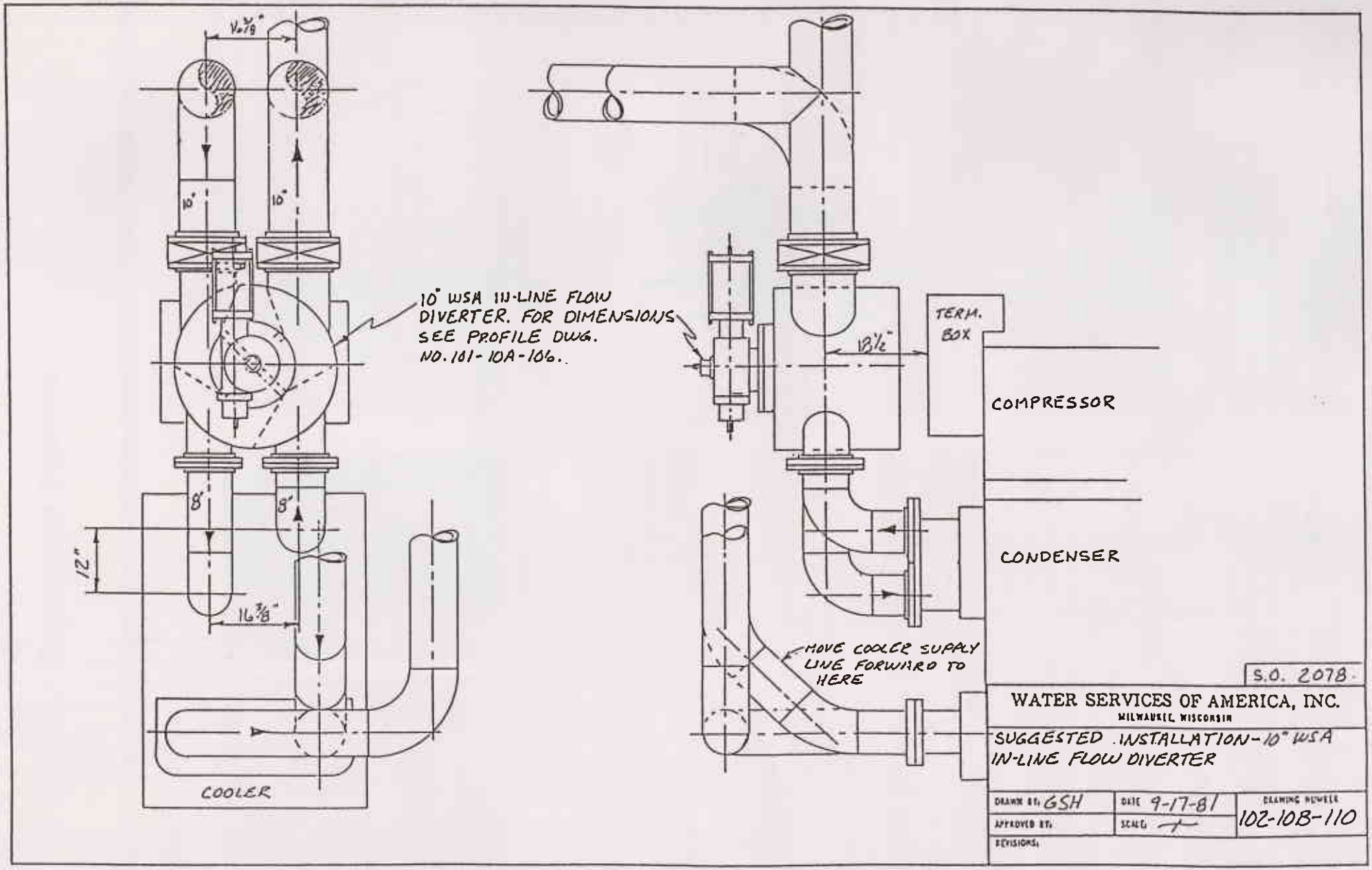
ZONE	NO.	DESCRIPTION	BY	DATE
		REVISION		

	INT.	DATE
DESIGNER		
DRAWN	GH	11-7-83
CHECKED		
APPROVED		
TOLERANCE: NONE		
SCALE: 3/4"=1'-0" DO NOT SCALE DWG.		

WATER SERVICES OF AMERICA, INC.
MILWAUKEE, WISCONSIN

SUGGESTED INSTALLATION - 10" WSA FUL-FLO IN-LINE FLOW DIVERTER

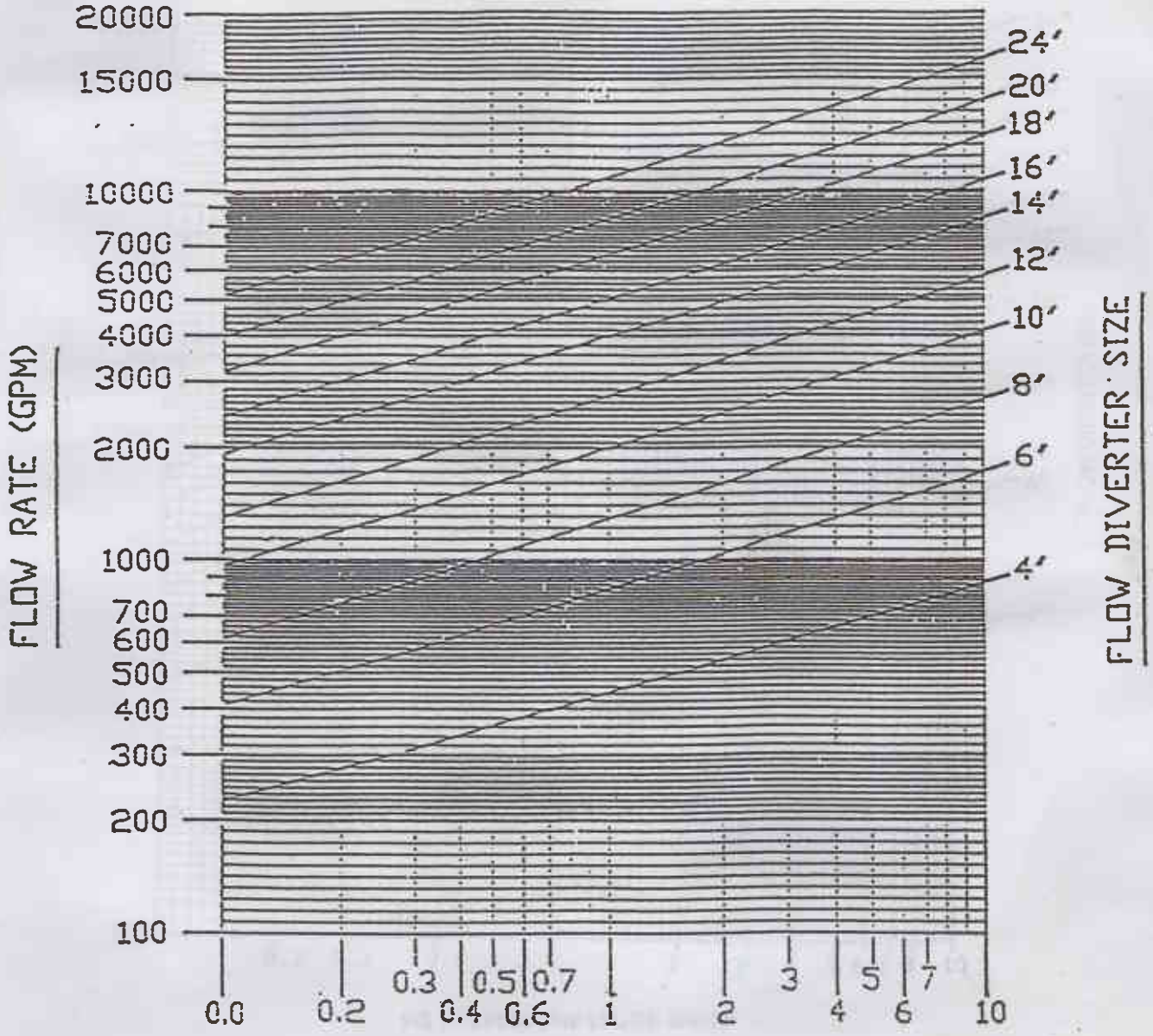
PROJECT NUMBER	DRAWING NUMBER	REV.	SHEET NUMBER
3322	102-10B-141	0	1 OF 1


10" WSA 111-LINE FLOW DIVERTER. FOR DIMENSIONS SEE PROFILE DWG. NO. 101-10A-106.
TERM. BOX
COMPRESSOR
CONDENSER
MOVE COOLER SUPPLY LINE FORWARD TO HERE
COOLER
10"
10"
8"
5"
12"
16 3/8"
13 1/2"
S.O. 2078
WATER SERVICES OF AMERICA, INC.
MILWAUKEE, WISCONSIN
SUGGESTED INSTALLATION-10" WSA IN-LINE FLOW DIVERTER
DRAWN BY: GSH
DATE 9-17-81
APPROVED BY:
SCALE
DRAWING NUMBER 102-10B-110
REVISIONS:

TECHNICAL DATA SHEET

System Pressure Drop

(brushes, baskets & diverter)



DIVERTER PRESSURE DROP

from curve above _____ psig

BRUSH AND BASKET DROP

Number of passes through exchanger

_____ x 0.35 _____ psig

Total HS System Pressure Drop _____ psig

THE COMPANY:

Leading the Industry

Since 1971, WSA has helped corporations, factories, hospitals, institutions, commercial buildings, airports, power plants, refineries, and chemical companies across the nation to save operating and maintenance expenses by providing unique, high-quality tube cleaning systems.

WSA has an ASME-approved manufacturing plant, machine shop, an R & D facility, a field service department, with central headquarters in Milwaukee, WI; other sales offices are located across North America. WSA serves clients through an extensive nationwide sales and service organization.

Our international office in West Germany and agents worldwide provide automatic tube cleaning systems around the globe. With the technology and the experience to create a cleaning system for any application, WSA can save clients money from the very first day of installation.

Advanced technology... demonstrated results... a proven track record with thousands of clients both large and small... and the ability to serve a global market: these qualities make WSA the industry leader in tube cleaning technology and systems.

Call today for more information or an on-site demonstration of WSA automatic tube cleaning system efficiency.

Medical Facility

Office Complex

Tobacco Company

Oil Refinery

THE EXPERIENCE

WSA Installations Across America and Around the World

WSA is proud to have helped many companies reduce operating and maintenance expenses through the installation of WSA automatic tube cleaning systems.

A partial listing of over 4,000 installation for WSA clients worldwide includes:

Allied Chemical
Amoco Oil Co.
Baltimore Gas and Electric
Chevron Oil
Dillards Dept. Stores
Dow Chemical
DuPont Company
Eastman Kodak
Exxon
General Motors
Hanes Hosiery
Hilton Hotels
Houston Medical Center
Humana Hospital
IBM Corporation
Johnson & Johnson
Kraft Dairy Products
Lockheed
Monsanto
Pacific Bell
Pennsylvania Power and Light
Phillip Morris
R. J. Reynolds Tobacco Co.
Rockwell International
Scott Air Force Base
Sun Oil Company
Uniroyal Chemical Company
University of Michigan
Veterans Administration Hospital
Xerox Corporation

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