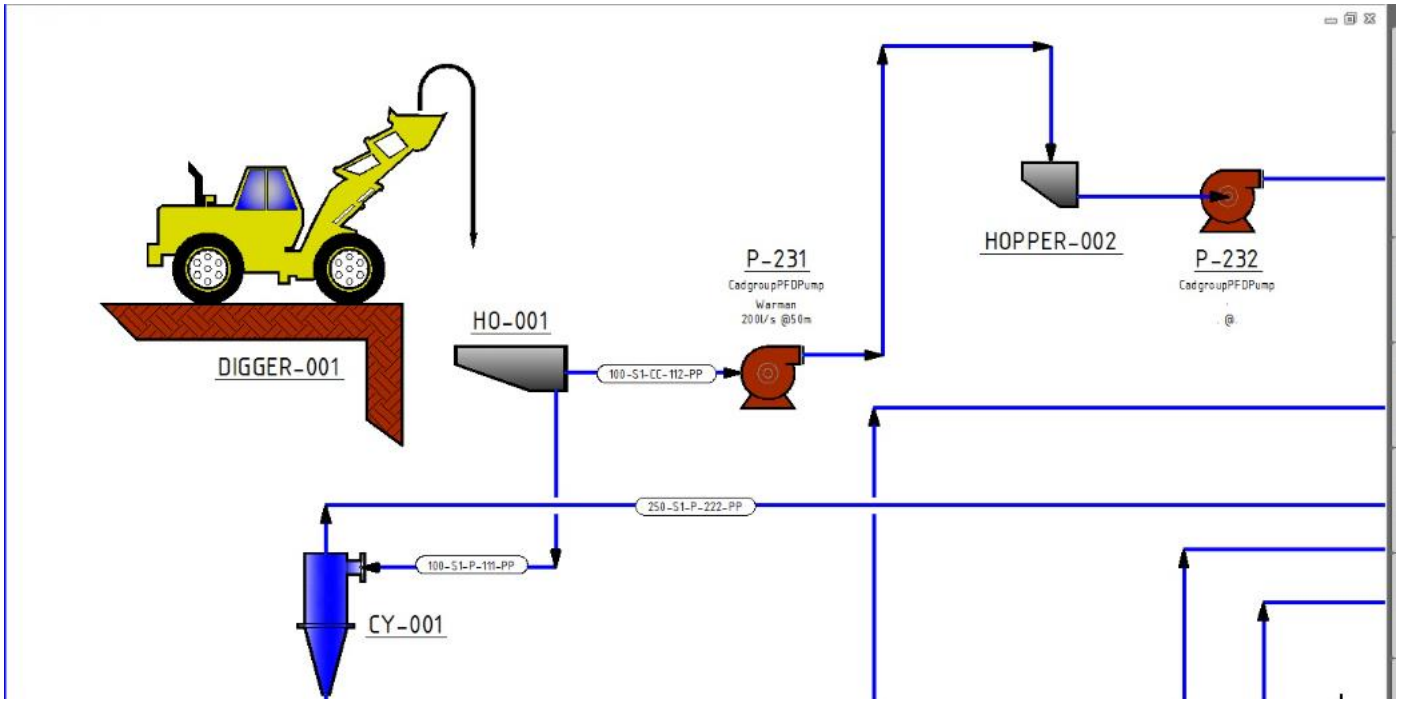
Process Flow / Instrumentation Drawings – P&FD / P&ID



It's a story told through *Symbology*

Version – 1.0, January 2019

American Water Works Association
Pacific Northwest Section

Prepared by the Training Coordination Committee, PNWS-AWWA

Acknowledgements:

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Symbology

An 1877 dictionary defines the word as:
"the art of expressing through symbols."

Content & Goals

To provide an understanding of what process flow and instrumentation drawings can tell us about how things work

Outline:

Workshop topics

Understanding a P&ID Layout

- The difference between P&ID and PFD
- Symbology
- Equipment
- Piping that connects the equipment
- Lines and instruments used to monitor and control the process

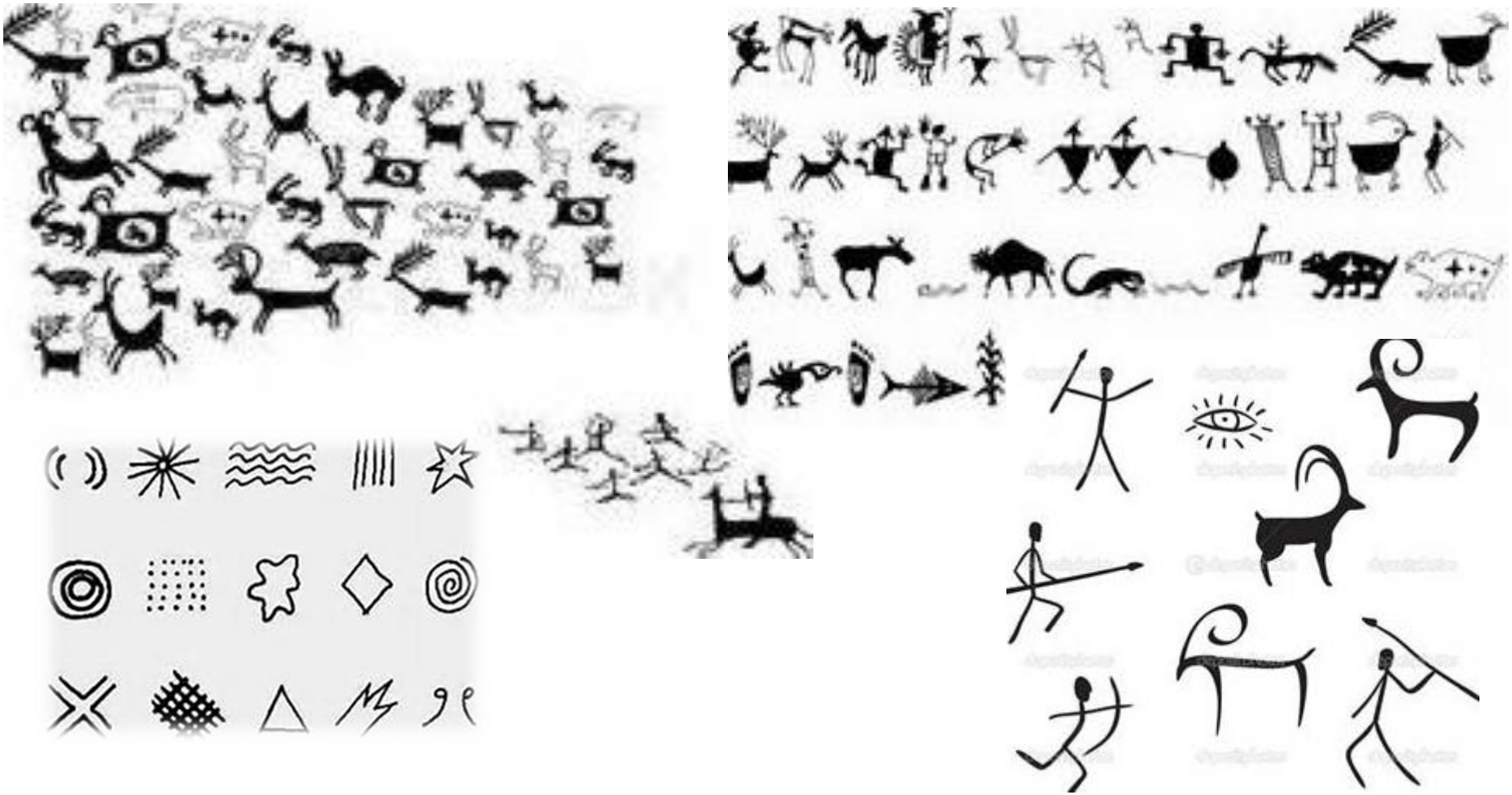
Symbols

Toki

Koru

Hei-Matu

Symbols & Story Telling



Earliest forms of communication during the prehistoric period were the Hieroglyphics and cave drawings

Evolution of Symbols

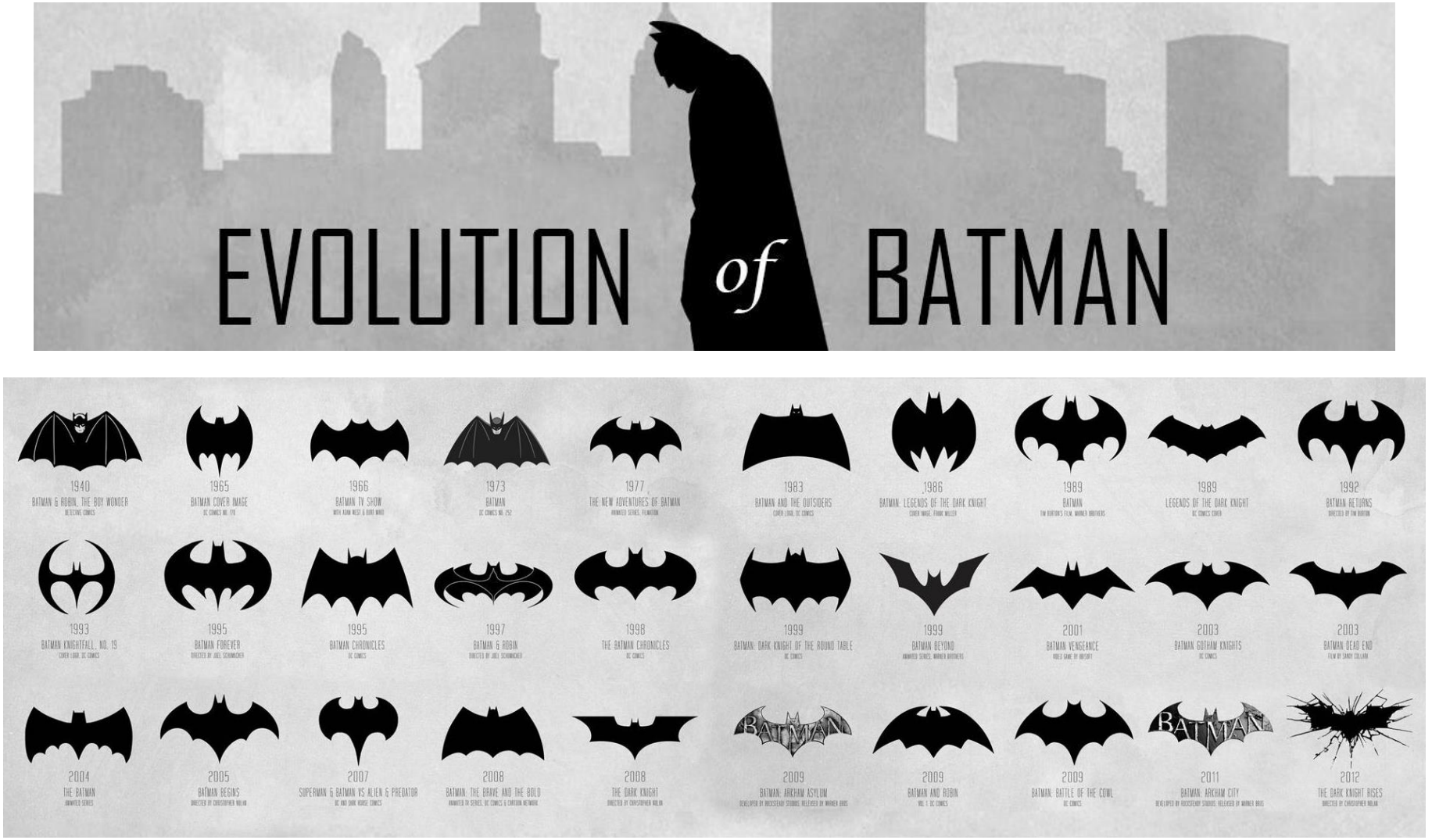


Photo caption

The Basics

- There are standards for symbols:
  - **AutoCAD P&ID ISA** – International society of automation
  - **AutoCAD P&ID PIP** – Process Industry Practices
  - **AutoCAD P&ID ISO** – International Organization for Standardization
- User defined “unique” symbols
- Use the symbol guide for the P&ID’s you are reading.

Photo caption

Where Can P&IDs Used?

- Everywhere in our conveyance and treatment systems:
  - Operator Training
  - Developing SOP's
  - Process Troubleshooting
  - Conveyance Information
  - Storage Information

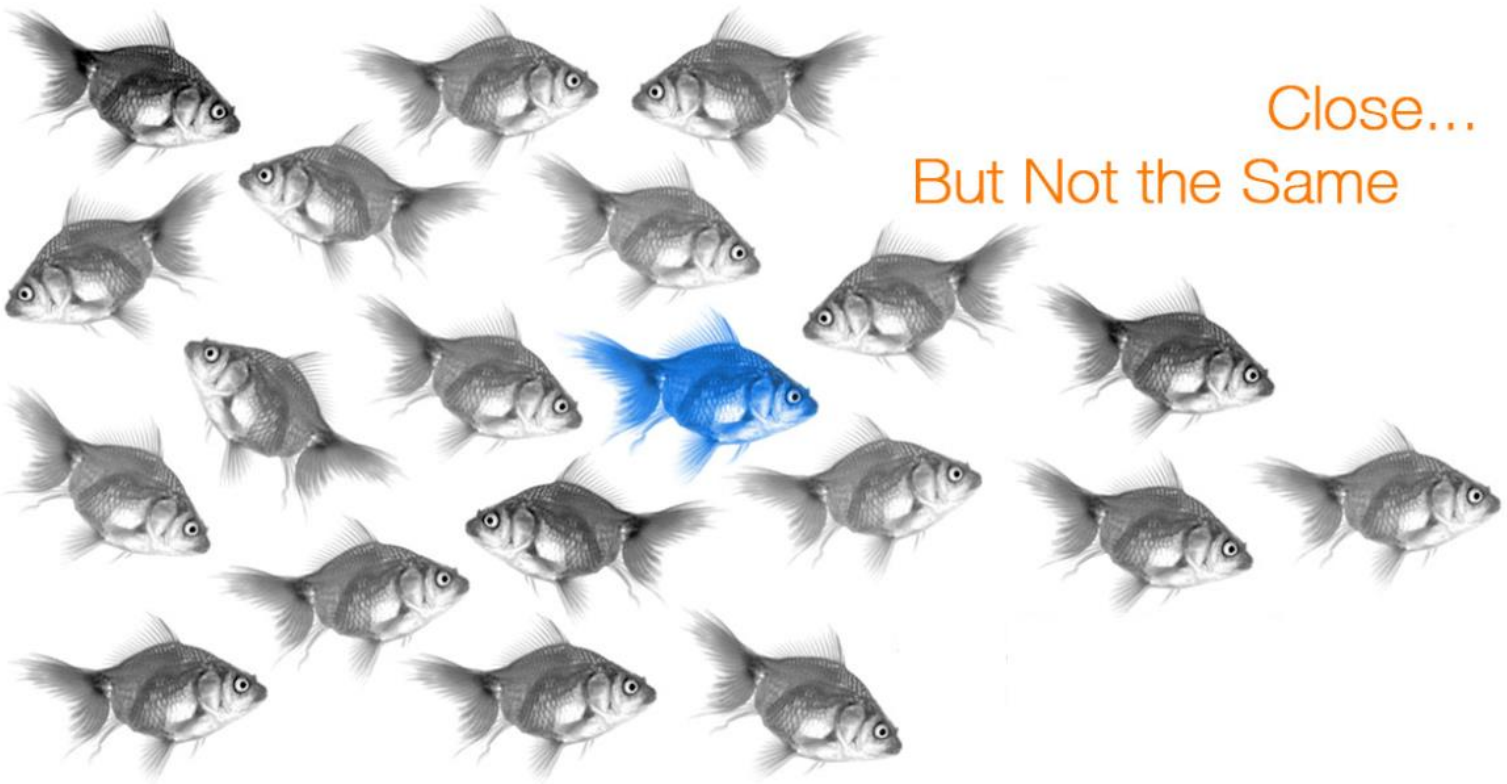
Photo caption

Where Can P&IDs Used?

- Everywhere in our conveyance and treatment systems:
  - Chemical feed systems
  - Hazard monitoring type and location
  - Sampling type and location
  - Security
  - Auxiliary services

Photo caption

PFD / P&ID Differences



The Process Flow Diagram

- Shows the flow of process and the equipment involved in the process.
- Shows the relationships between the major components minus the details.
- Are sometimes used for visitor information and new employee training.

A PFD should include:

- Process Piping

PRIMARY PROCESS FLOW

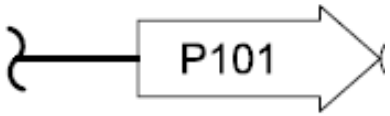
- Major equipment symbols, names and identification numbers

PUMP, PERISTALTIC

- Control, valves and valves that affect operation of the system

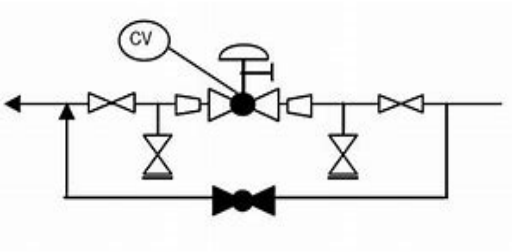
BUTTERFLY VALVE

- Interconnection with other systems



A PFD should include:

- Major bypass and recirculation lines



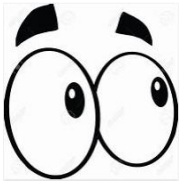
- Sometimes system ratings and operational values as minimum, normal and maximum flow, temperature and pressure

- Composition of fluids

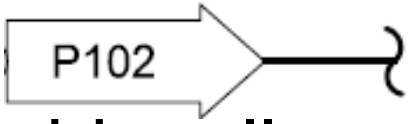
More Basics

- Process always flows from left to right

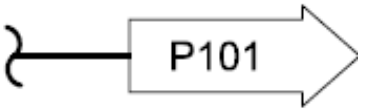
- The whole process doesn't always fit on one drawing



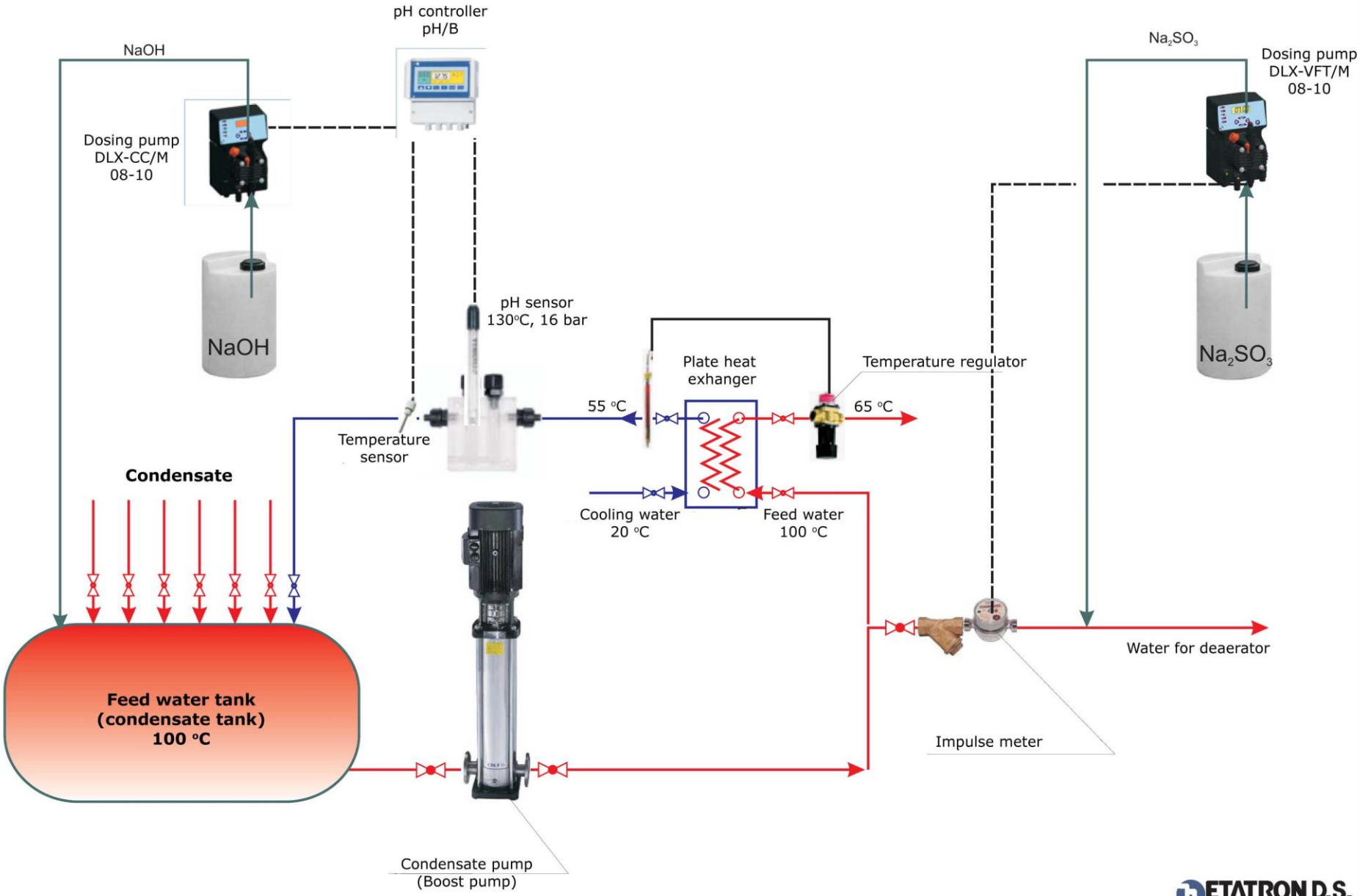
- Drawing numbers on the left side tells where the process is coming from



- Drawing number on the right side tells where the process is going to



Flow chart of water chemical deaeration and pH control



Simple Process Flow

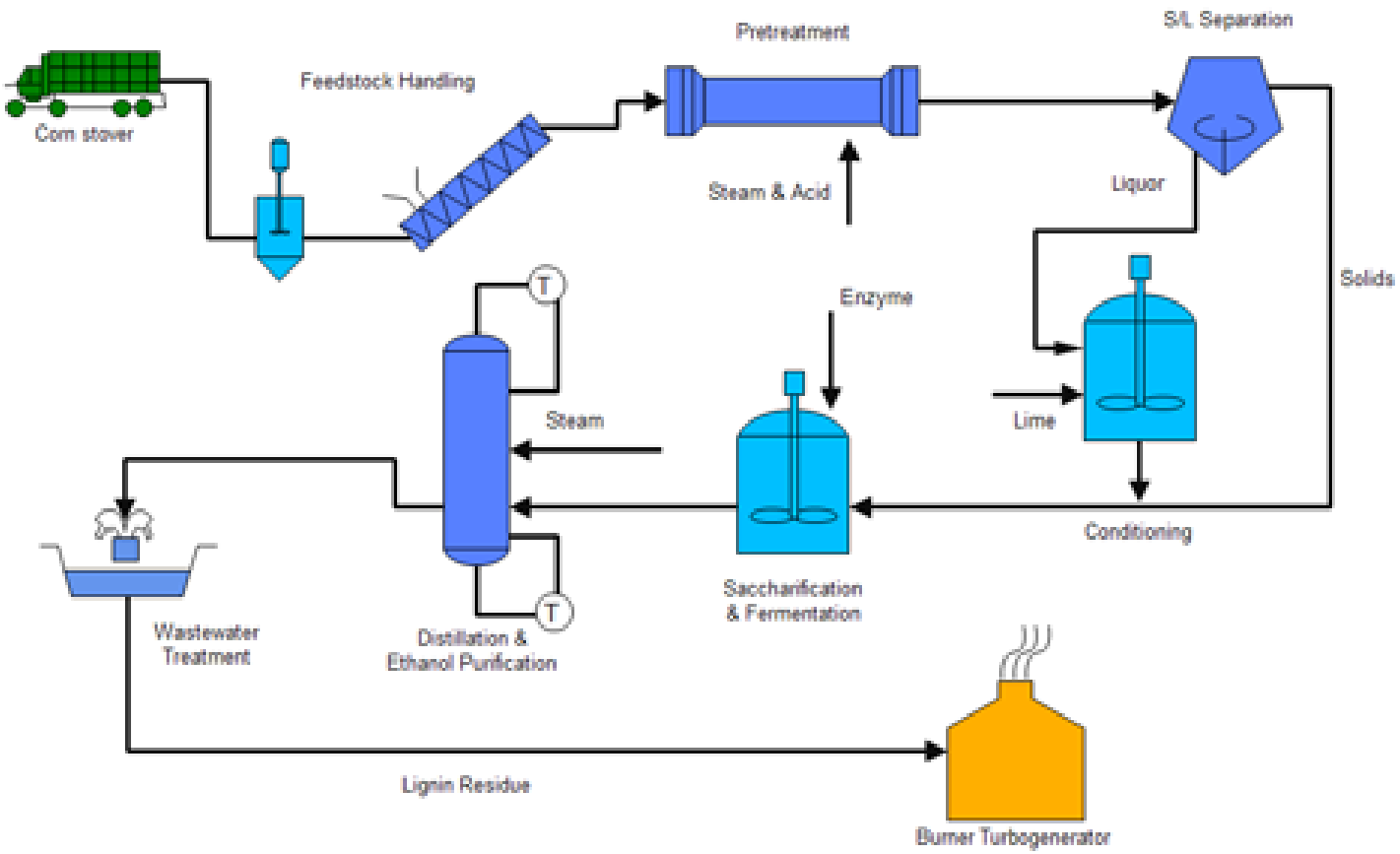
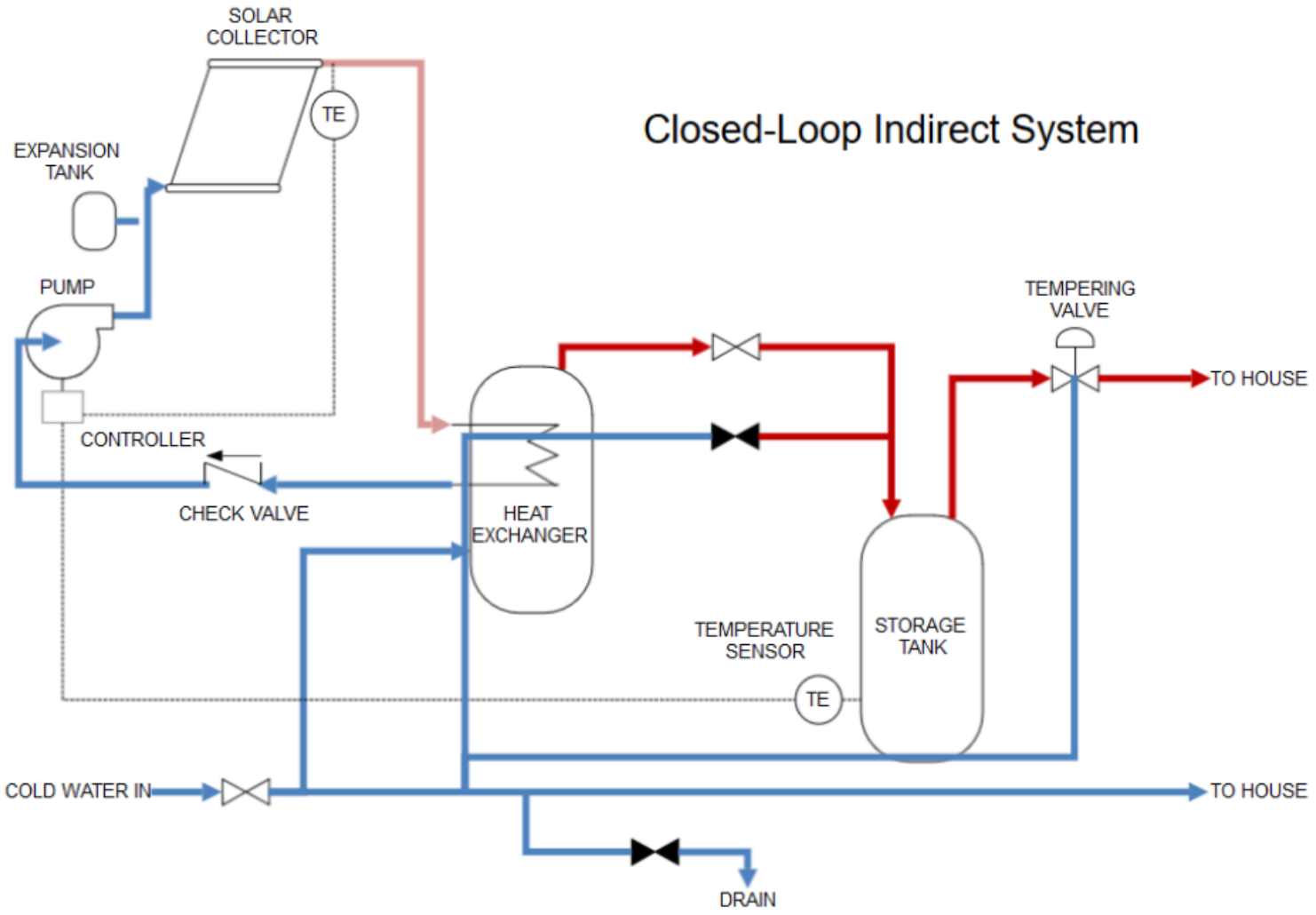
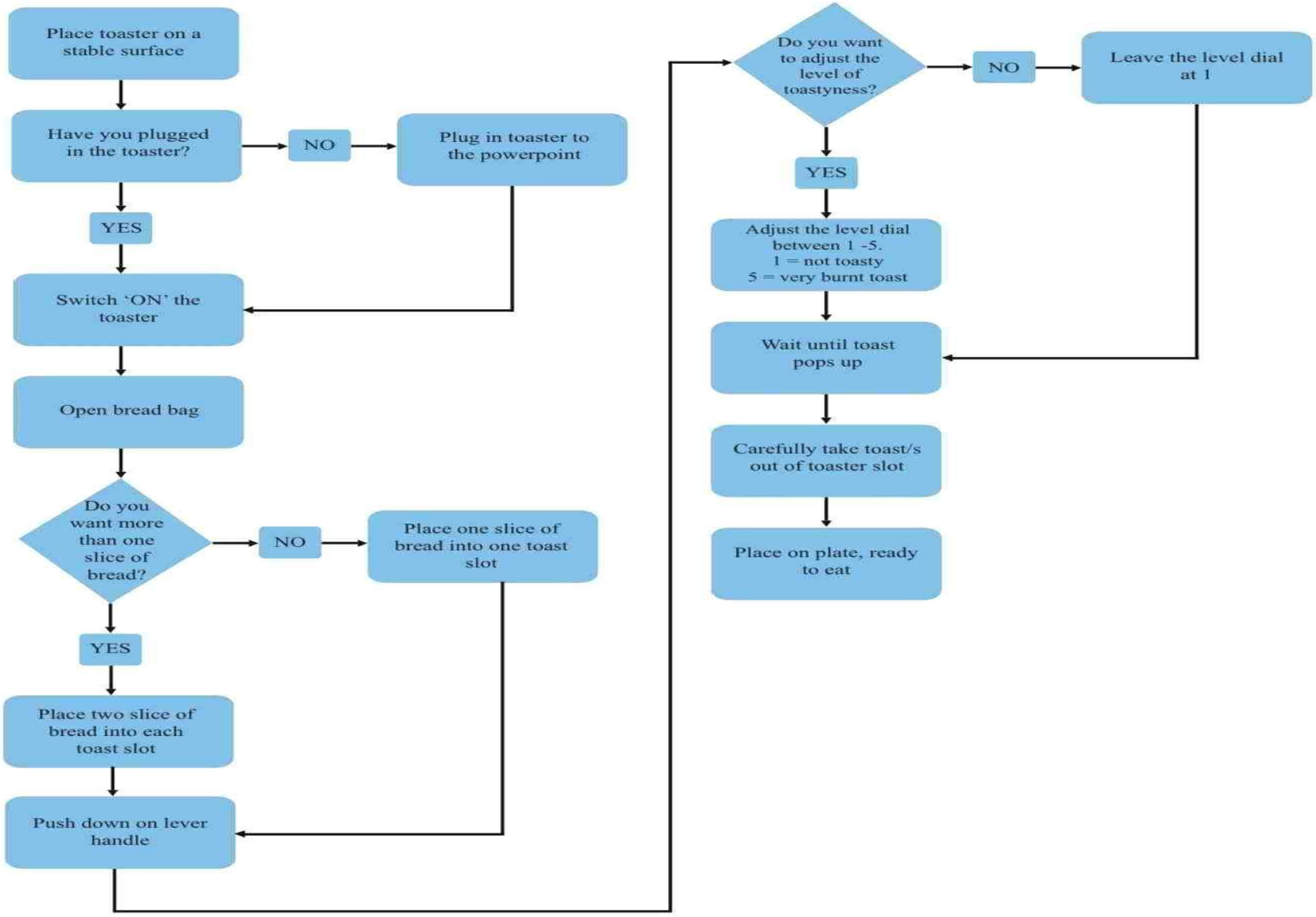


Photo caption

Process Flow Diagram



How To Make Toast



The Process & Instrumentation Diagram

- Process & Instrumentation Diagram (P&ID) show what is in the PFD
  - **plus** the instrumentation to monitor the process
  - **plus** how it is controlled.
- A P&ID shows the relationships between the all components in the system and shows details.

How A P&ID is Set Up

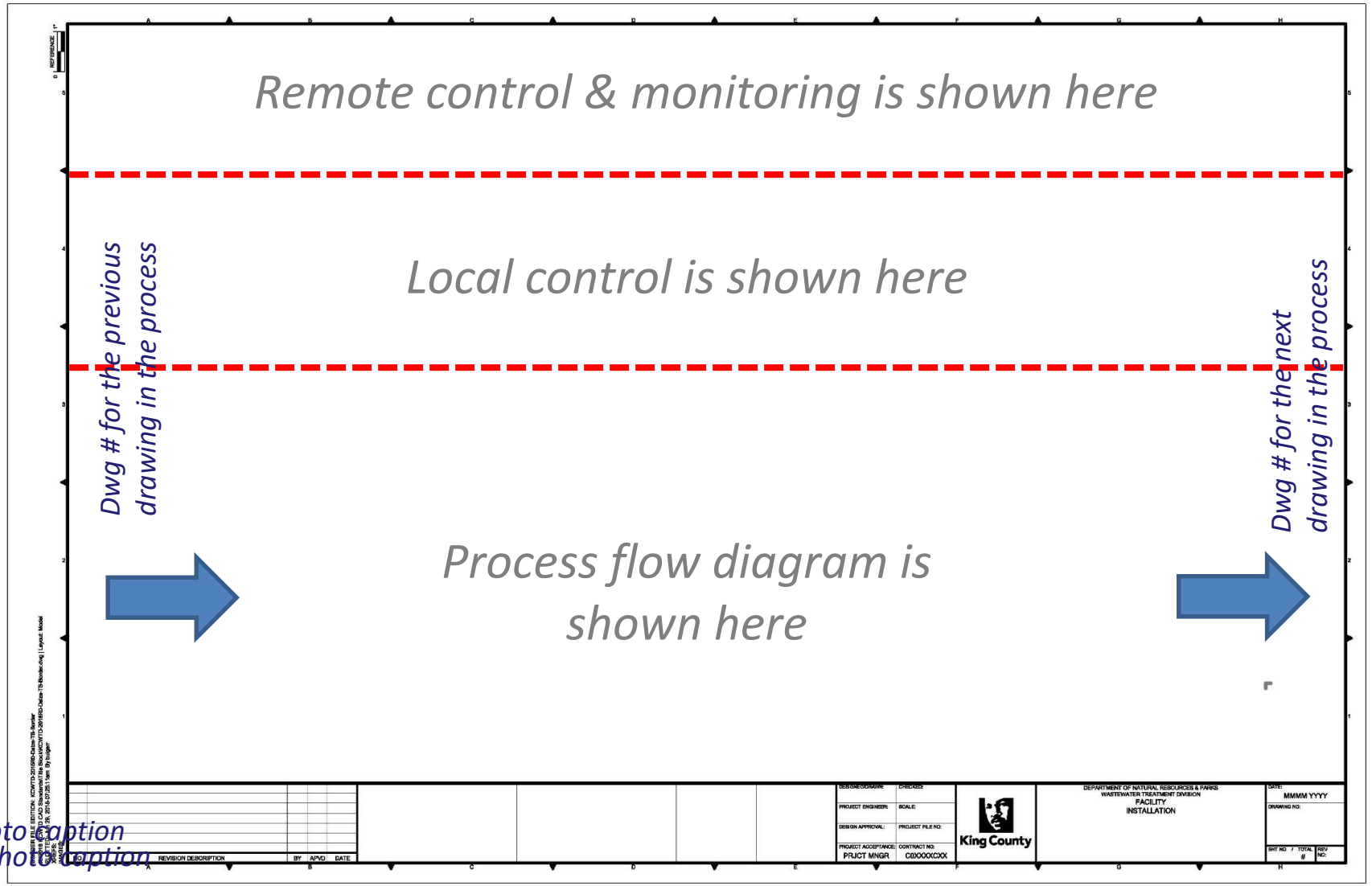


Photo caption
Photo caption

A P&ID Should Include:

- Instrumentation and designations
- Mechanical equipment with names & numbers
- All valves & their identifications
- Process piping, sizes & identification

A P&ID Should Include:

- Miscellaneous – vents, drains, special fittings, sampling lines, reducers & increasers
- Permanent start-up & flush lines
- Flow directions

A P&ID Should Also Include:

- Interconnections references
- Control inputs and outputs, interlocks
  Interfaces for class changes Seismic category
- Quality level
- Annunciation inputs

A P&ID Should Also Include:

- Computer control system input
- Vendor and contractor interfaces
- Identification of components and subsystems delivered by others
- Intended physical sequence of the equipment

A P&ID Should Not Include:

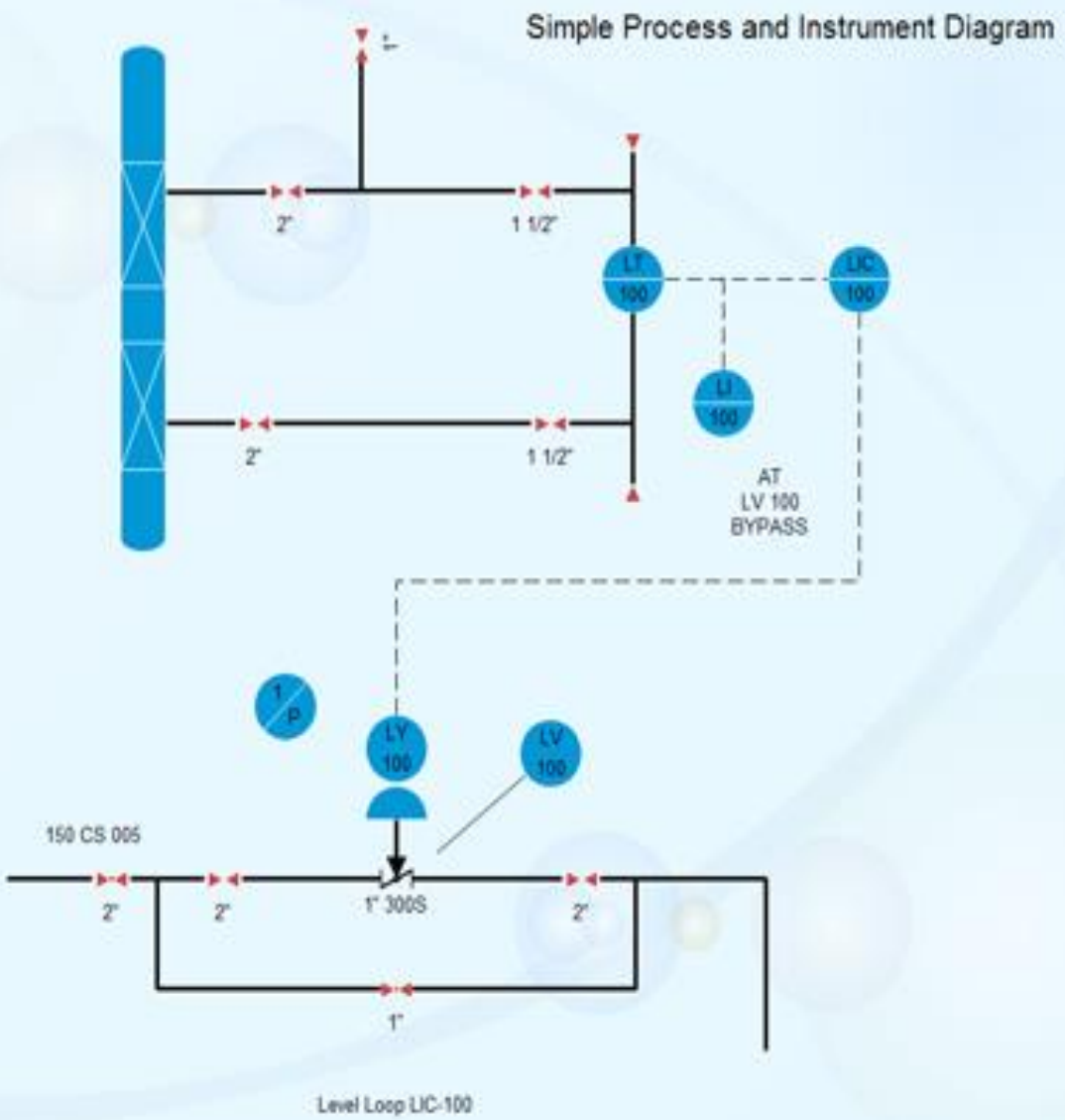
- Equipment rating or capacity
- Manual switches and indicating lights
- Primary instrument tubing and valves

Photo caption

A P&ID Should Not Include:

- Pressure temperature and flow data
- Elbows and similar standard fittings
- Extensive explanatory notes

Photo caption


Simple Process and Instrument Diagram
2"
1 1/2"
LT 100
LIC 100
LI 100
2"
1 1/2"
AT
LV 100
BYPASS
I/P
LV 100
LV 100
150 CS 005
2"
2"
1" 300S
2"
1"
Level Loop LIC-100

P&IDs

Work With the Process Narratives

Process narrative is the text description of the process, associated instrumentation, monitoring & control:

- **Operating set points**
- **Decision trees**
- **Describes the process**

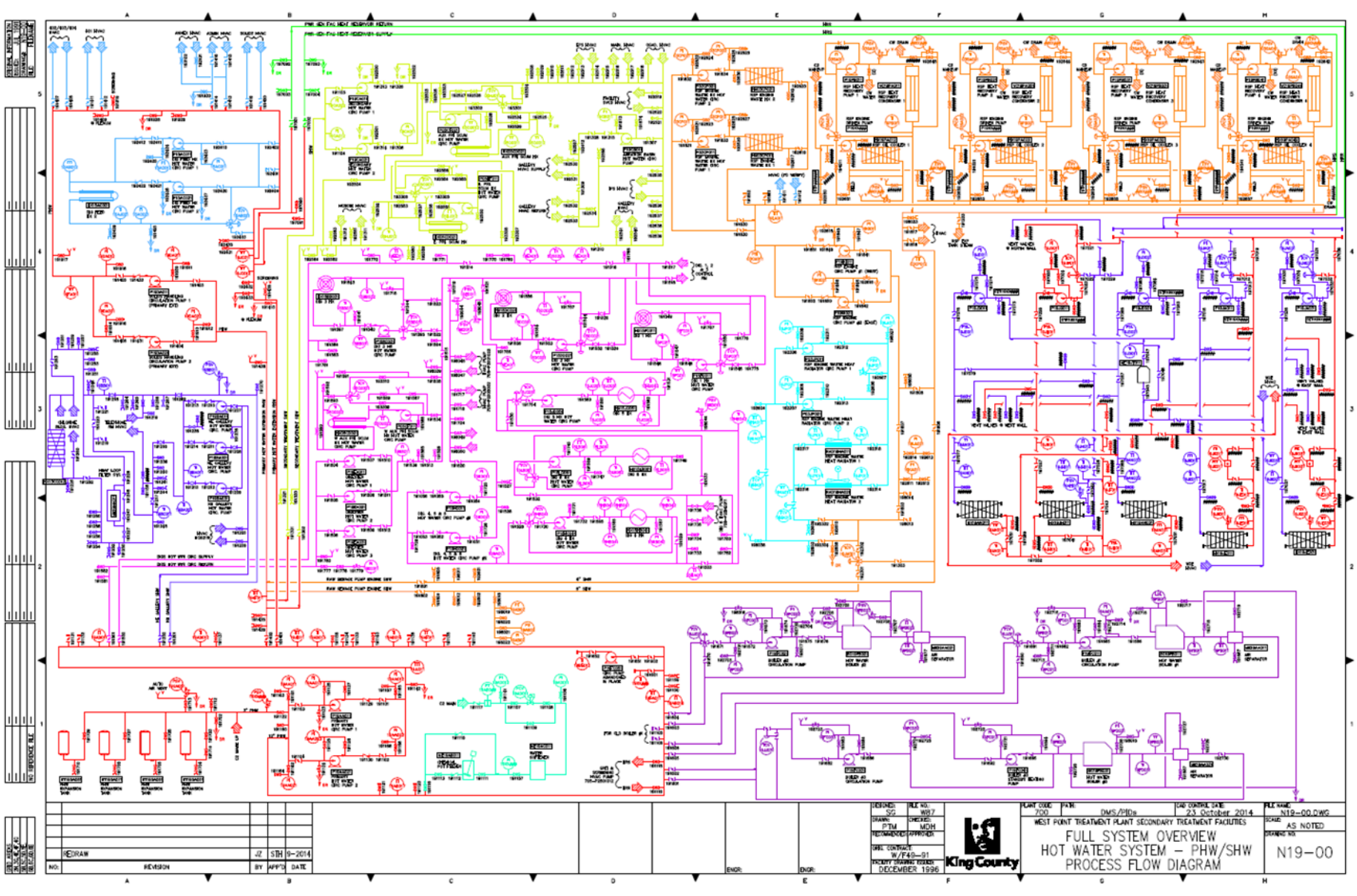
- **Describes the equipment**
- **Manual operation**
- **Automatic operation**

Who Uses P&IDs?

YOU DO! When:

- **Planning a project**
- **Writing a job safety analysis (JSA)**
- **Lockout before a repair or maintenance**
- **Troubleshooting when problems arise**
- **Process hazard review**
- **Training new employees**

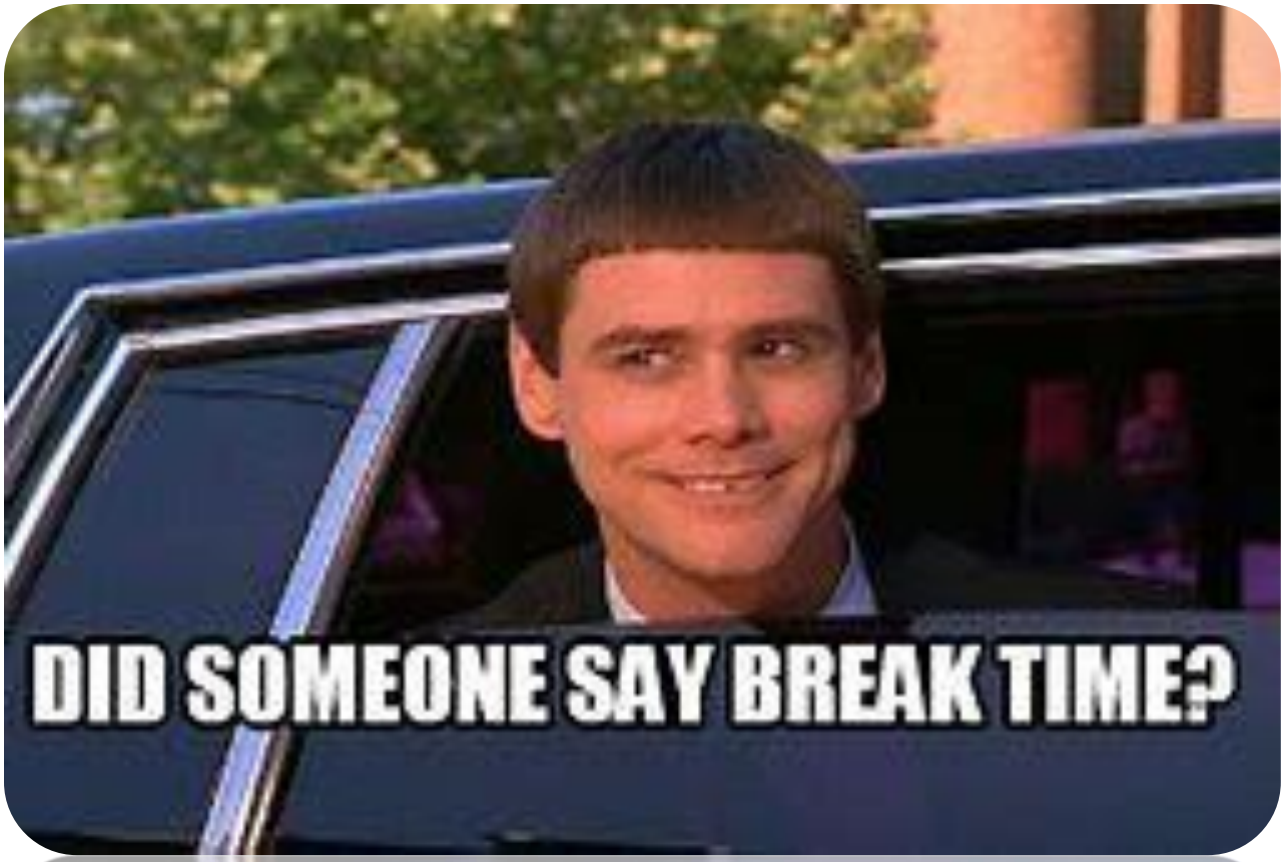
Photo caption



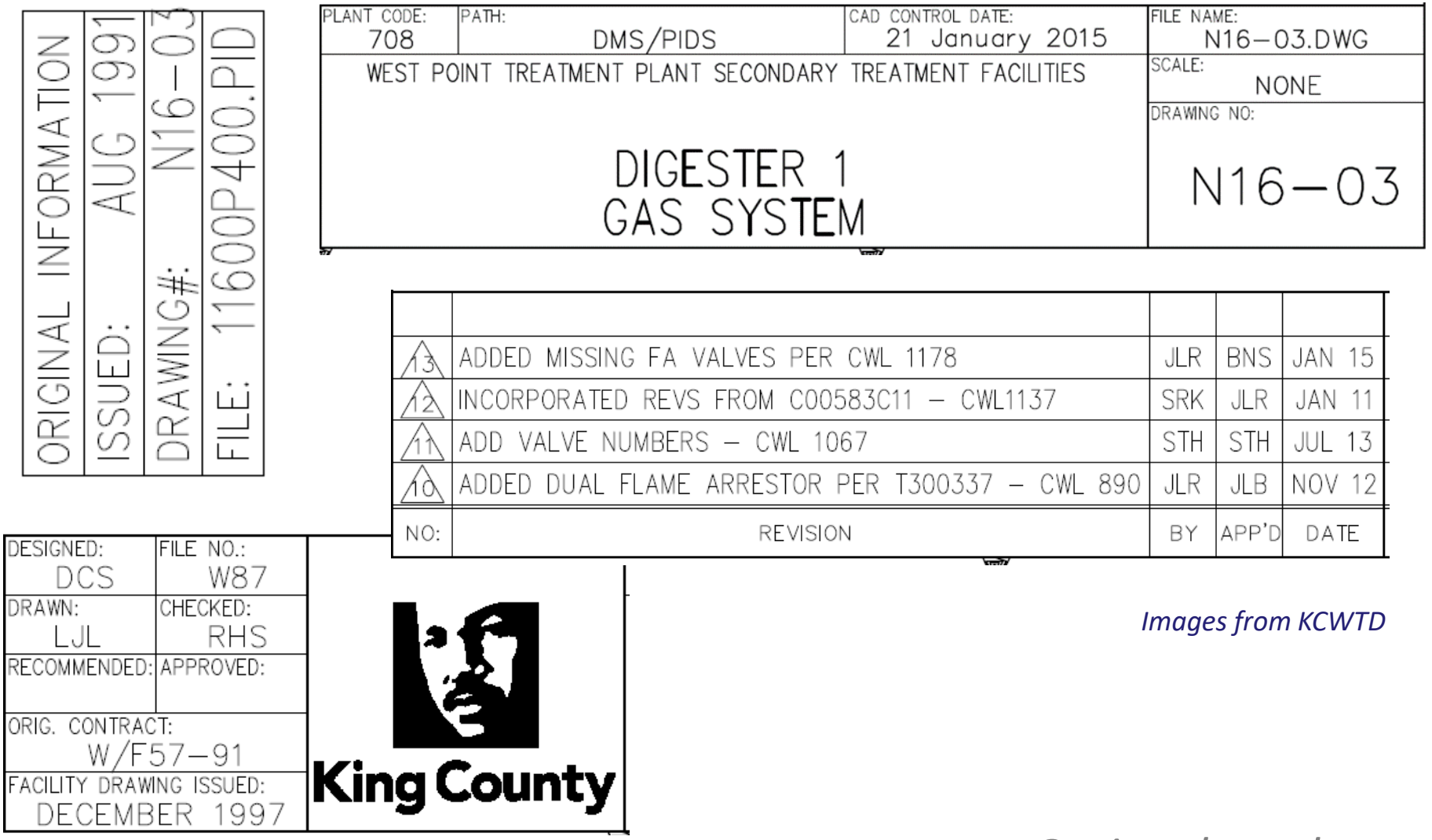
Graphic from KCWTD

Color can help understanding

Break Time



What The Parts Tell Us – Title Block



ORIGINAL INFORMATION
ISSUED: AUG 1991
DRAWING#: N16-03
FILE: 11600P400.PID

PLANT CODE: 708	PATH: DMS/PIDS	CAD CONTROL DATE: 21 January 2015	FILE NAME: N16-03.DWG
WEST POINT TREATMENT PLANT SECONDARY TREATMENT FACILITIES			SCALE: NONE
DIGESTER 1 GAS SYSTEM			DRAWING NO: N16-03

NO:	REVISION	BY	APP'D	DATE
13	ADDED MISSING FA VALVES PER CWL 1178	JLR	BNS	JAN 15
12	INCORPORATED REVS FROM C00583C11 – CWL1137	SRK	JLR	JAN 11
11	ADD VALVE NUMBERS – CWL 1067	STH	STH	JUL 13
10	ADDED DUAL FLAME ARRESTOR PER T300337 – CWL 890	JLR	JLB	NOV 12

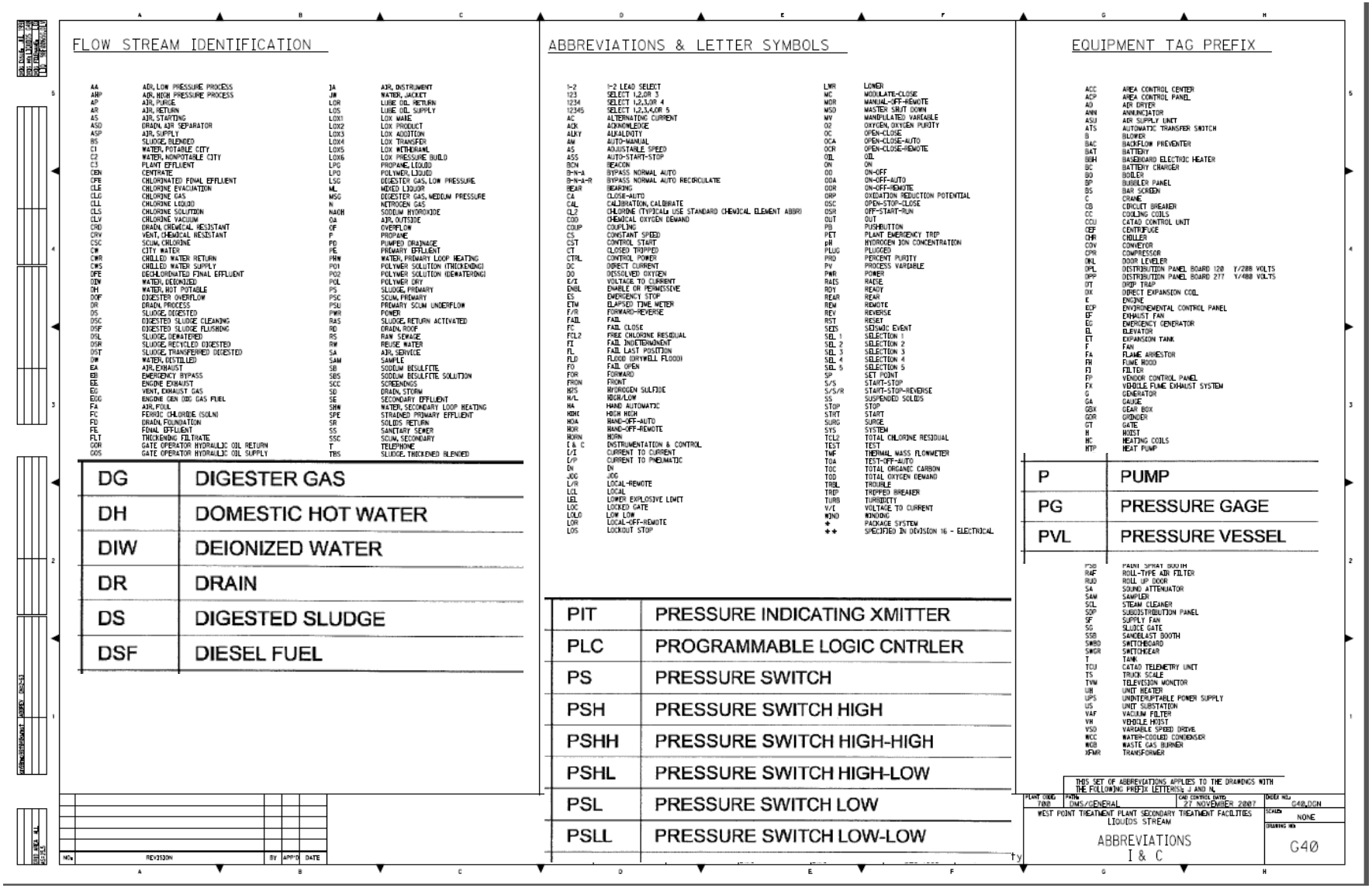
DESIGNED: DCS	FILE NO.: W87
DRAWN: LJL	CHECKED: RHS
RECOMMENDED:	APPROVED:
ORIG. CONTRACT: W/F57-91	
FACILITY DRAWING ISSUED: DECEMBER 1997	

King County

Images from KCWTD

Optional text here

Abbreviations



FLOW STREAM IDENTIFICATION

AA	AIR, LOW PRESSURE PROCESS	IA	AIR, INSTRUMENT
AHP	AIR, HIGH PRESSURE PROCESS	JW	WATER, JACKET
AP	AIR, PURGE	LOR	LUBE OIL RETURN
AR	AIR, RETURN	LOS	LUBE OIL SUPPLY
AS	AIR, STARTING	LOX1	LOX MAKE
ASD	DRAIN, AIR SEPARATOR	LOX2	LOX PRODUCT
ASP	AIR, SUPPLY	LOX3	LOX ADDITION
BS	SLUDGE, BLENDED	LOX4	LOX TRANSFER
C1	WATER, POTABLE CITY	LOX5	LOX WITHDRAWAL
C2	WATER, NONPOTABLE CITY	LOX6	LOX PRESSURE BUILD
C3	PLANT EFFLUENT	LPG	PROPANE, LIQUID
CEN	CENTRATE	LPD	POLYMER, LIQUID
CFE	CHLORINATED FINAL EFFLUENT	LSG	DIGESTER GAS, LOW PRESSURE
CLE	CHLORINE EVACUATION	ML	MIXED LIQUOR
CLG	CHLORINE GAS	MSG	DIGESTER GAS, MEDIUM PRESSURE
CLL	CHLORINE LIQUID	N	NITROGEN GAS
CLS	CHLORINE SOLUTION	NAOH	SODIUM HYDROXIDE
CLV	CHLORINE VACUUM	OA	AIR, OUTSIDE
CRD	DRAIN, CHEMICAL RESISTANT	OF	OVERFLOW
CRV	VENT, CHEMICAL RESISTANT	P	PROPANE
CSC	SCUM, CHLORINE	PD	PUMPED DRAINAGE
CW	CITY WATER	PE	PRIMARY EFFLUENT
CWR	CHILLED WATER RETURN	PHW	WATER, PRIMARY LOOP HEATING
CWS	CHILLED WATER SUPPLY	PO1	POLYMER SOLUTION (THICKENING)
DFE	DECHLORINATED FINAL EFFLUENT	PO2	POLYMER SOLUTION (DEWATERING)
DIW	WATER, DEIONIZED	POL	POLYMER DRY
DH	WATER, HOT POTABLE	PS	SLUDGE, PRIMARY
DOF	DIGESTER OVERFLOW	PSC	SCUM, PRIMARY
DR	DRAIN, PROCESS	PSU	PRIMARY SCUM UNDERFLOW
DS	SLUDGE, DIGESTED	PWR	POWER
DSC	DIGESTED SLUDGE CLEANING	RAS	SLUDGE, RETURN ACTIVATED
DSF	DIGESTED SLUDGE FLUSHING	RD	DRAIN, ROOF
DSL	SLUDGE, DEWATERED	RS	RAW SEWAGE
DSR	SLUDGE, RECYCLED DIGESTED	RW	REUSE WATER
DST	SLUDGE, TRANSFERRED DIGESTED	SA	AIR, SERVICE
DW	WATER, DISTILLED	SAM	SAMPLE
EA	AIR, EXHAUST	SB	SODIUM BISULFITE
EB	EMERGENCY BYPASS	SBS	SODIUM BISULFITE SOLUTION
EE	ENGINE EXHAUST	SCC	SCREENINGS
EG	VENT, EXHAUST GAS	SD	DRAIN, STORM
EGG	ENGINE GEN (DIG GAS FUEL	SE	SECONDARY EFFLUENT
FA	AIR, FOUL	SHW	WATER, SECONDARY LOOP HEATING
FC	FERRIC CHLORIDE (SOLN)	SPE	STRAINED PRIMARY EFFLUENT
FD	DRAIN, FOUNDATION	SR	SOLIDS RETURN
FE	FINAL EFFLUENT	SS	SANITARY SEWER
FLT	THICKENING FILTRATE	SSC	SCUM, SECONDARY
GOR	GATE OPERATOR HYDRAULIC OIL RETURN	T	TELEPHONE
GOS	GATE OPERATOR HYDRAULIC OIL SUPPLY	TBS	SLUDGE, THICKENED BLENDED

DG	DIGESTER GAS
DH	DOMESTIC HOT WATER
DIW	DEIONIZED WATER
DR	DRAIN
DS	DIGESTED SLUDGE
DSF	DIESEL FUEL

ABBREVIATIONS & LETTER SYMBOLS

1-2	1-2 LEAD SELECT	LWR	LOWER
123	SELECT 1,2,OR 3	MC	MODULATE-CLOSE
1234	SELECT 1,2,3,OR 4	MOR	MANUAL-OFF-REMOTE
12345	SELECT 1,2,3,4,OR 5	MSD	MASTER SHUT DOWN
AC	ALTERNATING CURRENT	MV	MANIPULATED VARIABLE
ACK	ACKNOWLEDGE	O2	OXYGEN, OXYGEN PURITY
ALKY	ALKALINITY	OC	OPEN-CLOSE
AM	AUTO-MANUAL	OCA	OPEN-CLOSE-AUTO
AS	ADJUSTABLE SPEED	OCR	OPEN-CLOSE-REMOTE
ASS	AUTO-START-STOP	OIL	OIL
BCN	BEACON	ON	ON
B-N-A	BYPASS NORMAL AUTO	OO	ON-OFF
B-N-A-R	BYPASS NORMAL AUTO RECIRCULATE	OOA	ON-OFF-AUTO
BEAR	BEARING	OOR	ON-OFF-REMOTE
CA	CLOSE-AUTO	ORP	OXIDATION REDUCTION POTENTIAL
CAL	CALIBRATION, CALIBRATE	OSC	OPEN-STOP-CLOSE
CL2	CHLORINE (TYPICAL; USE STANDARD CHEMICAL ELEMENT ABBR)	OSR	OFF-START-RUN
COD	CHEMICAL OXYGEN DEMAND	OUT	OUT
COUP	COUPLING	PB	PUSHBUTTON
CS	CONSTANT SPEED	PET	PLANT EMERGENCY TRIP
CST	CONTROL START	pH	HYDROGEN ION CONCENTRATION
CT	CLOSED TRIPPED	PLUG	PLUGGED
CTRL	CONTROL POWER	PRD	PERCENT PURITY
DC	DIRECT CURRENT	PV	PROCESS VARIABLE
DO	DISSOLVED OXYGEN	PWR	POWER
E/I	VOLTAGE TO CURRENT	RAIS	RAISE
ENBL	ENABLE OR PERMISSIVE	RDY	READY
ES	EMERGENCY STOP	REAR	REAR
ETM	ELAPSED TIME METER	REM	REMOTE
F/R	FORWARD-REVERSE	REV	REVERSE
FAIL	FAIL	RST	RESET
FC	FAIL CLOSE	SEIS	SEISMIC EVENT
FCL2	FREE CHLORINE RESIDUAL	SEL 1	SELECTION 1
FI	FAIL INDETERMINENT	SEL 2	SELECTION 2
FL	FAIL LAST POSITION	SEL 3	SELECTION 3
FLD	FLOOD (DRYWELL FLOOD)	SEL 4	SELECTION 4
FO	FAIL OPEN	SEL 5	SELECTION 5
FOR	FORWARD	SP	SET POINT
FRON	FRONT	S/S	START-STOP
H2S	HYDROGEN SULFIDE	S/S/R	START-STOP-REVERSE
H/L	HIGH/LOW	SS	SUSPENDED SOLIDS
HA	HAND AUTOMATIC	STOP	STOP
HDH	HIGH HIGH	STRT	START
HOA	HAND-OFF-AUTO	SURG	SURGE
HOR	HAND-OFF-REMOTE	SYS	SYSTEM
HORN	HORN	TCL2	TOTAL CHLORINE RESIDUAL
I & C	INSTRUMENTATION & CONTROL	TEST	TEST
I/I	CURRENT TO CURRENT	TMF	THERMAL MASS FLOWMETER
I/P	CURRENT TO PNEUMATIC	TOA	TEST-OFF-AUTO
IN	IN	TOC	TOTAL ORGANIC CARBON
JOG	JOG	TOD	TOTAL OXYGEN DEMAND
L/R	LOCAL-REMOTE	TRBL	TROUBLE
LCL	LOCAL	TRIP	TRIPPED BREAKER
LEL	LOWER EXPLOSIVE LOMIT	TURB	TURBIDITY
LOC	LOCKED GATE	V/I	VOLTAGE TO CURRENT
LOLO	LOW LOW	WIND	WINDING
LOR	LOCAL-OFF-REMOTE	*	PACKAGE SYSTEM
LOS	LOCKOUT STOP	**	SPECIFIED IN DIVISION 16 - ELECTRICAL

PIT	PRESSURE INDICATING XMITTER
PLC	PROGRAMMABLE LOGIC CNTRLER
PS	PRESSURE SWITCH
PSH	PRESSURE SWITCH HIGH
PSHH	PRESSURE SWITCH HIGH-HIGH
PSHL	PRESSURE SWITCH HIGH-LOW
PSL	PRESSURE SWITCH LOW
PSLL	PRESSURE SWITCH LOW-LOW

EQUIPMENT TAG PREFIX

ACC	AREA CONTROL CENTER
ACP	AREA CONTROL PANEL
AD	AIR DRYER
ANN	ANNUNCIATOR
ASU	AIR SUPPLY UNIT
ATS	AUTOMATIC TRANSFER SWITCH
B	BLOWER
BAC	BACKFLOW PREVENTER
BAT	BATTERY
BBH	BASEBOARD ELECTRIC HEATER
BC	BATTERY CHARGER
BO	BOILER
BP	BUBBLER PANEL
BS	BAR SCREEN
C	CRANE
CB	CIRCUIT BREAKER
CC	COOLING COILS
CCU	CATAD CONTROL UNIT
CEF	CENTRIFUGE
CHR	CHILLER
COV	CONVEYOR
CPR	COMPRESSOR
DKL	DOOR LEVELER
DPL	DISTRIBUTION PANEL BOARD 120 Y/208 VOLTS
DPP	DISTRIBUTION PANEL BOARD 277 Y/480 VOLTS
DT	DROP TRAP
DX	DIRECT EXPANSION COIL
E	ENGINE
ECP	ENVIRONMENTAL CONTROL PANEL
EF	EXHAUST FAN
EG	EMERGENCY GENERATOR
EL	ELEVATOR
ET	EXPANSION TANK
F	FAN
FA	FLAME ARRESTOR
FH	FUME HOOD
FJ	FILTER
FP	VENDOR CONTROL PANEL
FX	VEHICLE FUME EXHAUST SYSTEM
G	GENERATOR
GA	GAUGE
GBX	GEAR BOX
GDR	GRINDER
GT	GATE
H	HOIST
HC	HEATING COILS
HTP	HEAT PUMP
PSB	PAINT SPRAY BOOTH
RAF	ROLL-TYPE AIR FILTER
RUD	ROLL UP DOOR
SA	SOUND ATTENUATOR
SAM	SAMPLER
SCL	STEAM CLEANER
SDP	SUBDISTRIBUTION PANEL
SF	SUPPLY FAN
SG	SLUICE GATE
SSB	SANDBLAST BOOTH
SWBD	SWITCHBOARD
SWGR	SWITCHGEAR
T	TANK
TCU	CATAD TELEMETRY UNIT
TS	TRUCK SCALE
TVM	TELEVISION MONITOR
UH	UNIT HEATER
UPS	UNINTERUPTABLE POWER SUPPLY
US	UNIT SUBSTATION
VAF	VACUUM FILTER
VH	VEHICLE HOIST
VSD	VARIABLE SPEED DRIVE
WCC	WATER-COOLED CONDENSER
WGB	WASTE GAS BURNER
XFMR	TRANSFORMER

P	PUMP
PG	PRESSURE GAGE
PVL	PRESSURE VESSEL

THIS SET OF ABBREVIATIONS APPLIES TO THE DRAWINGS WITH THE FOLLOWING PREFIX LETTERS: J AND NL

PLANT CODE	PATH	CAD CONTROL DATED	ORDER NO.
700	DMS/GENERAL	27 NOVEMBER 2007	G40.DGN

WEST POINT TREATMENT PLANT SECONDARY TREATMENT FACILITIES
LIQUIDS STREAM

ABBREVIATIONS
I & C

SCALE: NONE

DRAWING NO: G40

NO.	REVISION	BY	APP'D	DATE

Instrument Identification

INSTRUMENT SOCIETY OF AMERICA TABLE

FIRST LETTER			SUCCEEDING LETTERS		
MEASURED OR INITIATING VARIABLE		MODIFIER	READOUT OR PASSIVE FUNCTION	OUTPUT FUNCTION	MODIFIER
A	ANALYSIS		ALARM	ALARM	AUTO
B	BURNER FLAME		USER'S CHOICE	USER'S CHOICE	USER'S CHOICE
C	CONDUCTIVITY (ELECTRICAL)			CONTROL	CLOSED
D	DENSITY (MASS) OR SPECIFIC GRAVITY	DIFFERENTIAL			FAIL, ERROR ABNORMAL
E	VOLTAGE (EMF)		PRIMARY ELEMENT		
F	FLOW RATE	RATIO (FRACTION)			
G	GAUGING (DIMENSIONAL)		GLASS		READY
H	HAND (MANUALLY INITIATED)				HIGH
I	CURRENT (ELECTRICAL)		INDICATE		
J	POWER	SCAN			RUNNING, RUN
K	TIME OR TIME SCHEDULE	TIME RATE OF CHANGE		CONTROL STATION	STOP
L	LEVEL		LIGHT (PILOT)		LOW, LOCAL
M	MOTOR OR MOISTURE	MOMENTARY			MID
N	EQUIPMENT				
O	USER'S CHOICE		ORIFICE (RESTRICTION)		OPEN
P	PRESSURE OR VACUUM		POINT (TEST CONNECTION)		
Q	QUANTITY	INTEGRATE OR TOTALIZE			
R	RADIATION		RECORD OR PRINT		REMOTE
S	SPEED OR FREQUENCY	SAFETY		SWITCH	
T	TEMPERATURE			TRANSMIT	
U	MULTIVARIABLE		MULTIFUNCTION	MULTIFUNCTION	MULTIFUNCTION
V	VIBRATION			VALVE, DAMPER, OR LOUVER	
W	TORQUE, WEIGHT, FORCE		WELL		
X	UNCLASSIFIED		PLC INPUT	UNCLASSIFIED	
Y	EVENT			RELAY OR COMPUTER OR PLC OUTPUT	
Z	POSITION			DRIVE, ACTUATE OR UNCLASSIFIED FINAL CONTROL ELEMENT	

Images from KCWTD

Line Legend

MAIN PROCESS FLOW
(WITH TYPICAL DIRECTION OF FLOW SHOWN)

SECONDARY PROCESS FLOW
(WITH TYPICAL DIRECTION OF FLOW SHOWN)

ANALOG SIGNAL LINE

DISCRETE SIGNAL LINE

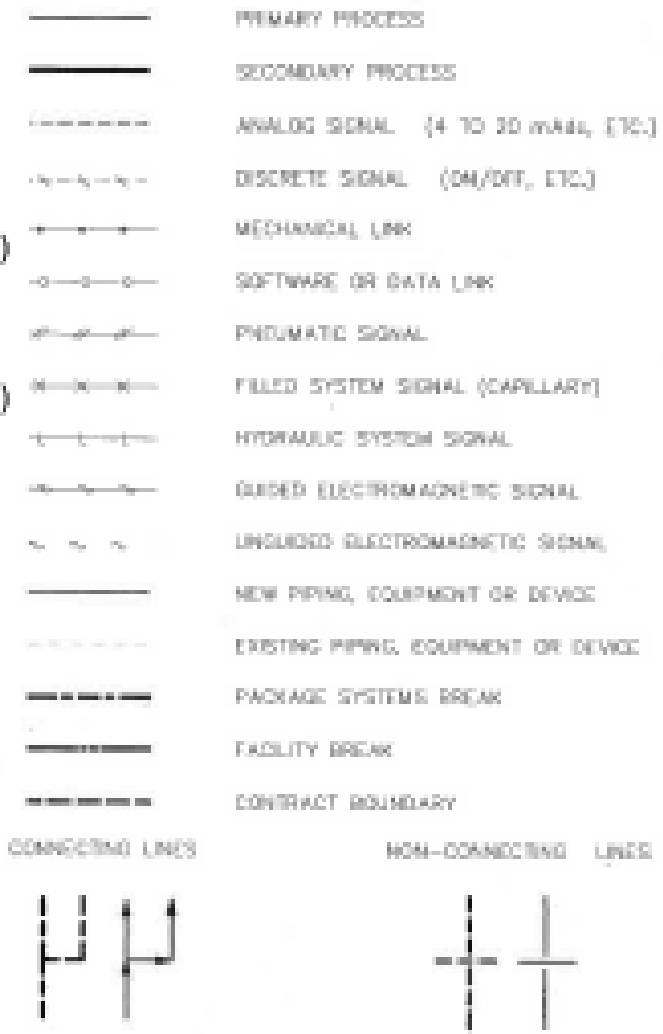


Photo caption

Tag Numbers

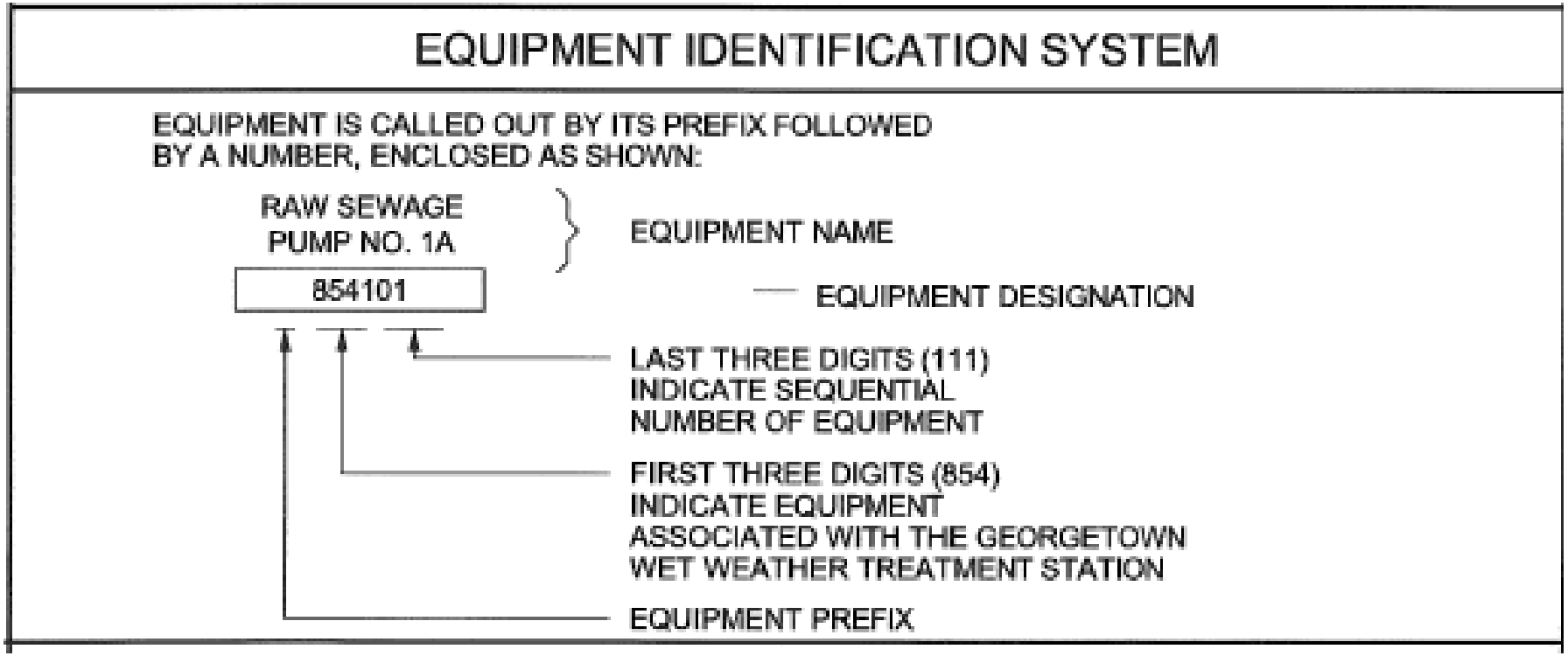
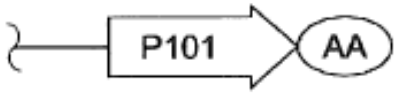


Photo caption

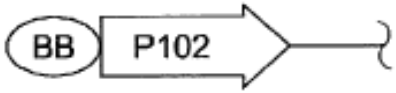
Optional text here

Interface Symbols



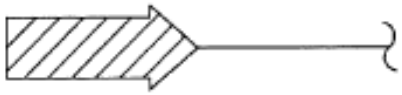
REMARK LINE 1
REMARK LINE 2

PROCESS/
SIGNAL FLOW INTERFACE
AA = CONNECTOR NUMBER
P101 = DESTINATION DRAWING NO.



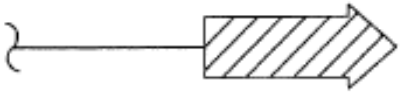
REMARK LINE 1
REMARK LINE 2

PROCESS/
SIGNAL FLOW INTERFACE
BB = CONNECTOR NUMBER
P102 = SOURCE DRAWING NO.



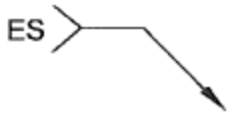
REMARK LINE 1
REMARK LINE 2

FROM PROCESS EXTERNAL
TO PROJECT



REMARK LINE 1
REMARK LINE 2

TO PROCESS EXTERNAL
FROM PROJECT



ELECTRIC SUPPLY
ES: DEFINES TYPE OF SUPPLY
EXAMPLE:
120=120VAC, SINGLE PHASE

Photo caption

Optional text here

Construction Status

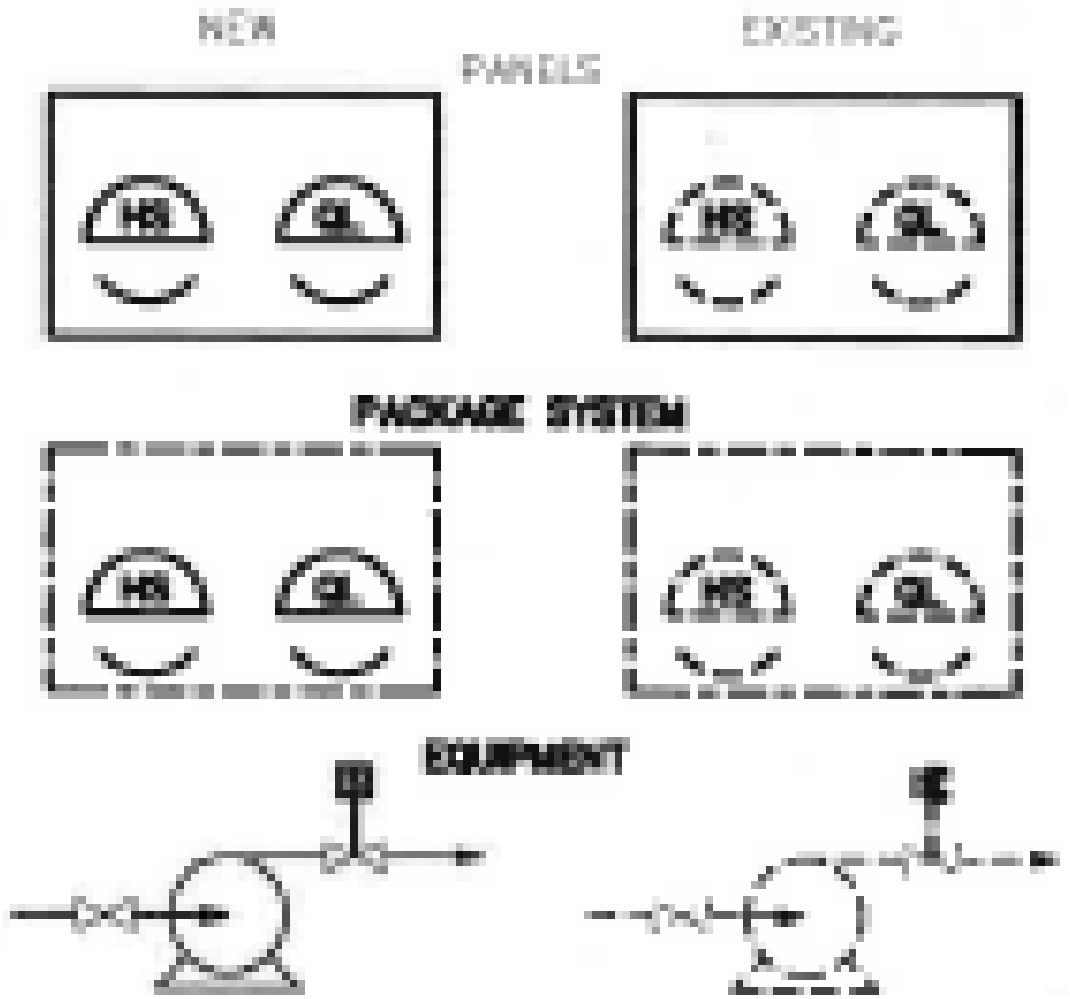


Photo caption

Optional text here

Valve Symbols

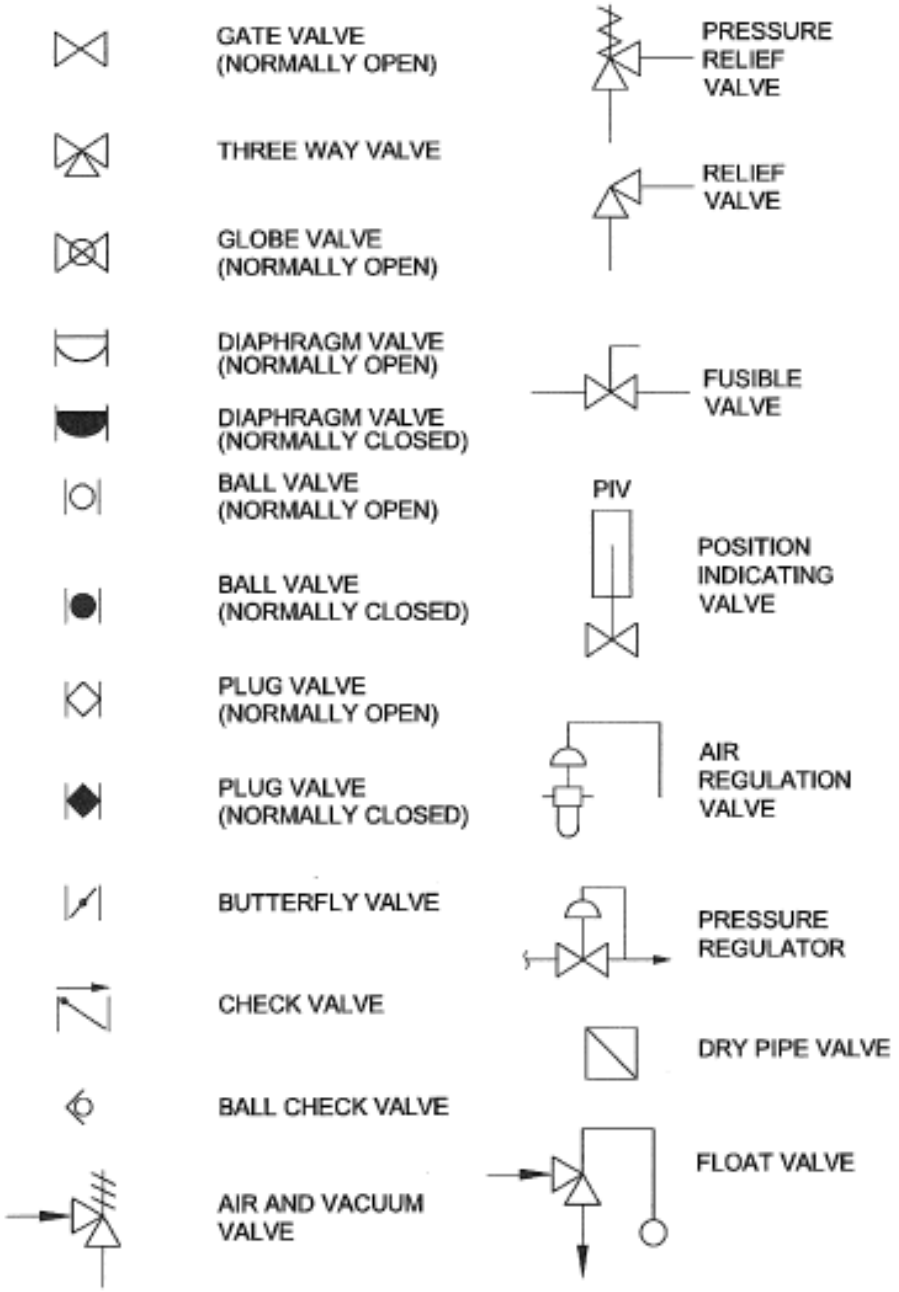


Photo caption

Gate Symbols

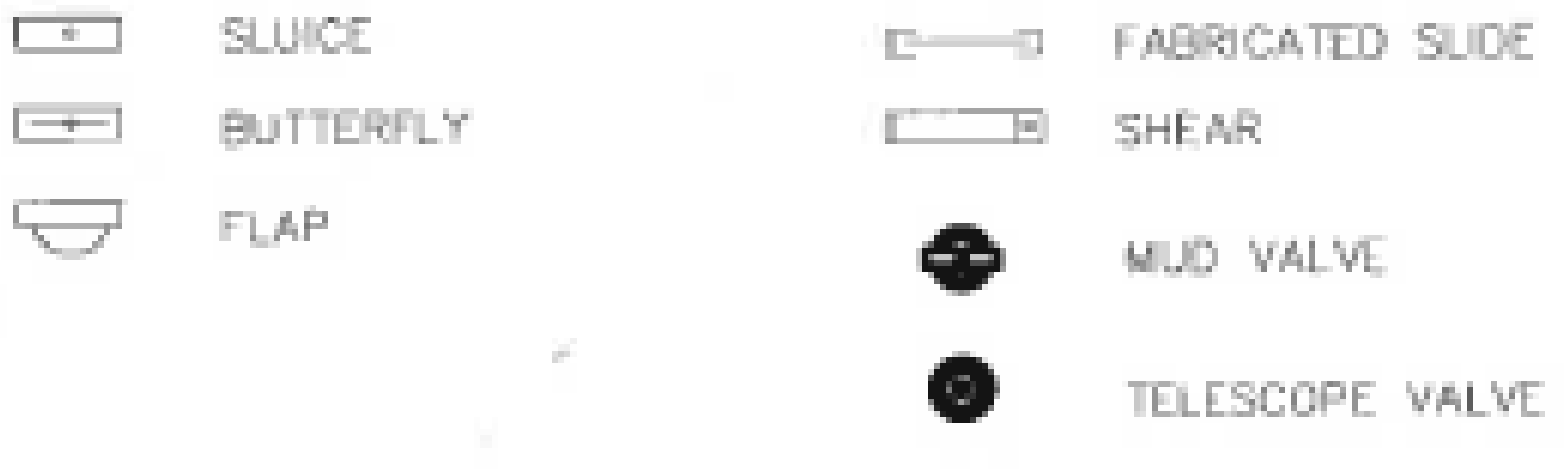


Photo caption

Actuator Symbols

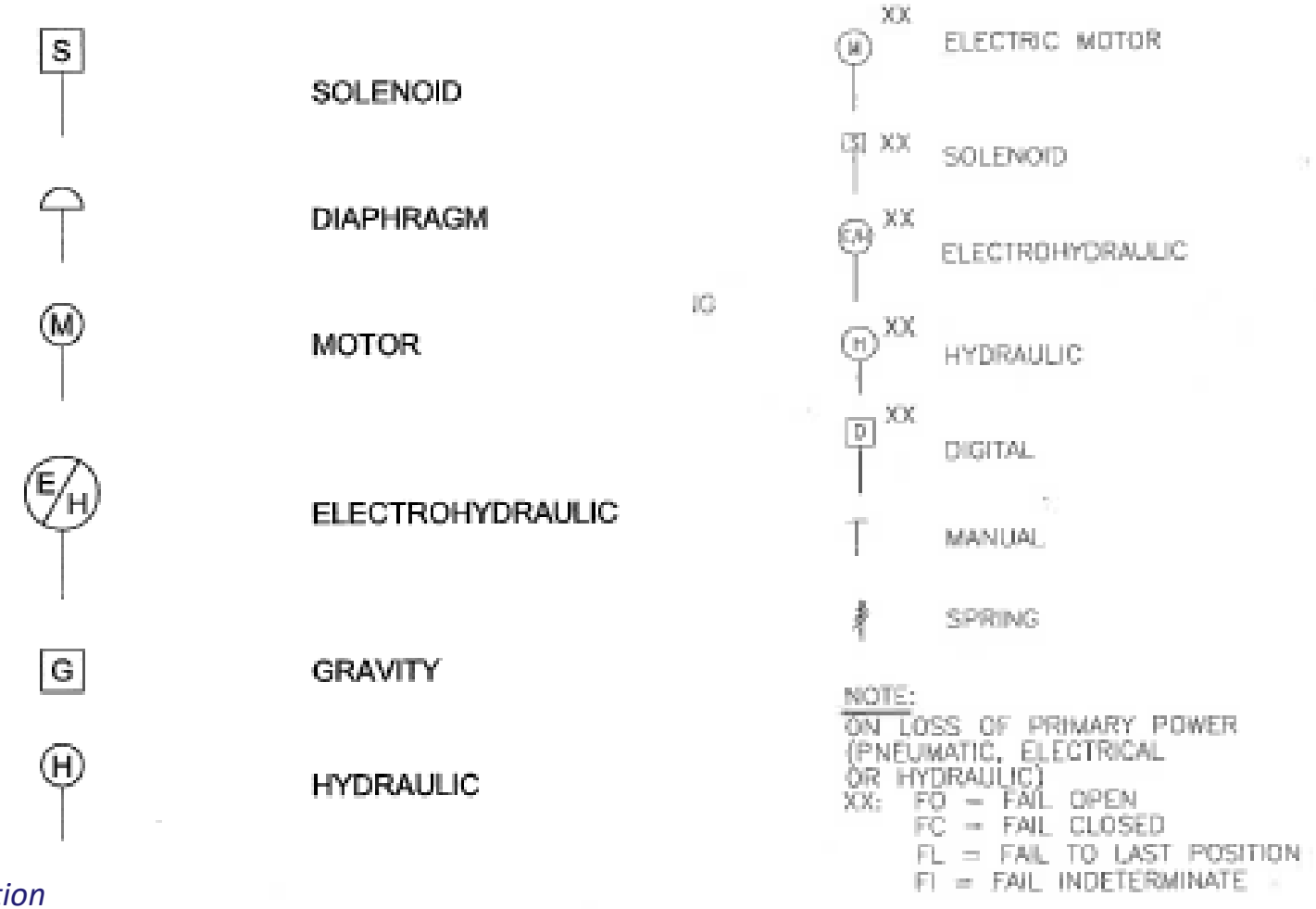
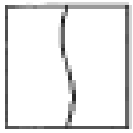


Photo caption

Mechanical Equipment Symbols

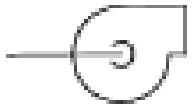


HEATER

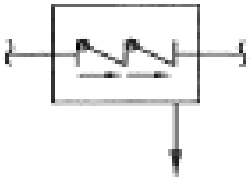
WEIR

GENERATOR

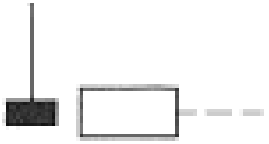
RECEIVER, PRESSURE VESSEL OR SCRUBBER



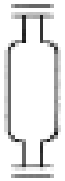
PUMP, CENTRIFUGAL



REDUCED PRESSURE BACKFLOW PREVENTER



SPEED SENSOR (RPM)



SILENCER

Photo caption

Optional text here

Primary Element Symbols

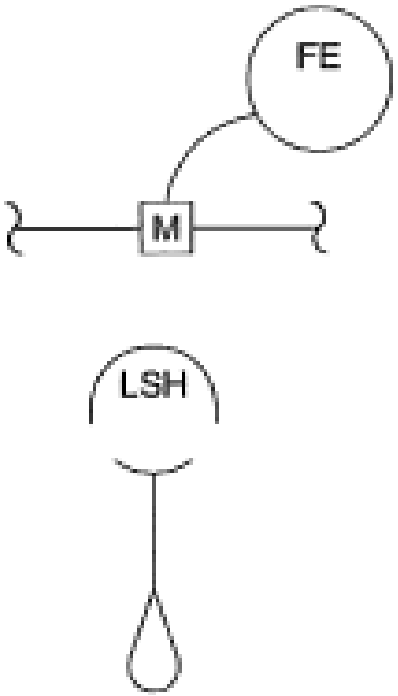
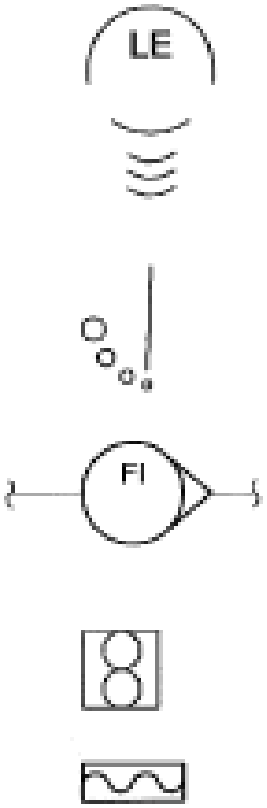


Photo caption

MAGNETIC FLOW TUBE

FLOAT SWITCH
(HIGH WATER LEVEL)



ULTRASONIC LEVEL ELEMENT

BUBBLER

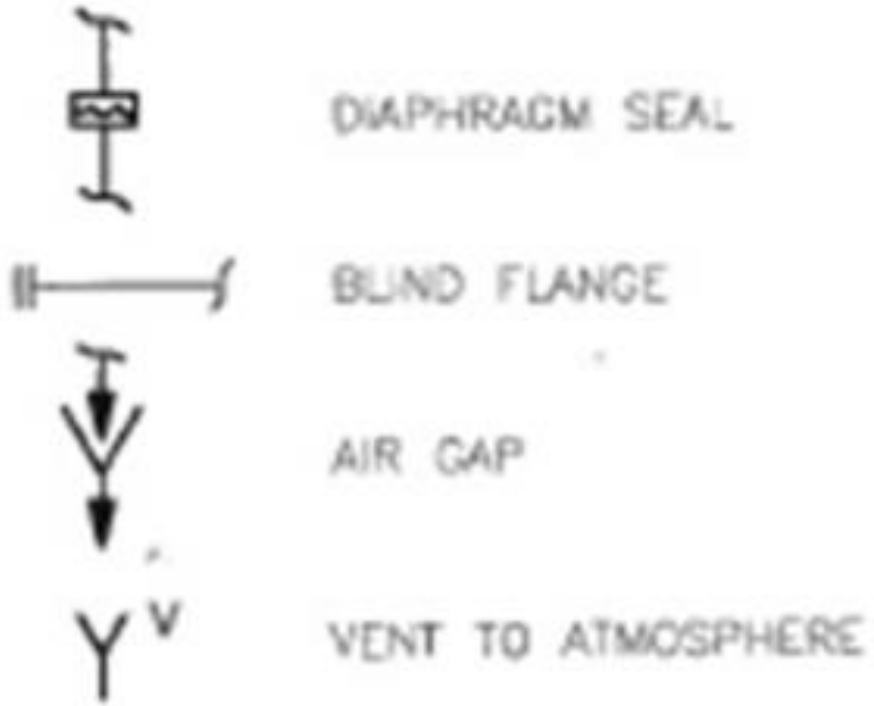
VARIABLE AREA FLOW INDICATOR (ROTAMETER)

UTILITY METER

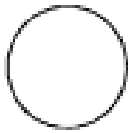
DIAPHRAGM SEAL

Optional text here

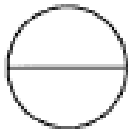
Miscellaneous Symbols



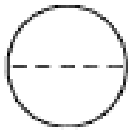
Functional Logic Diagrams



FIELD DEVICE
FOR DESCRIPTION
SEE TABLE

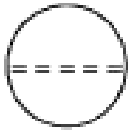


PANEL FRONT
DEVICE

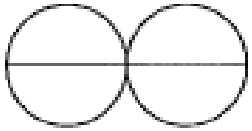


INTERNAL PANEL
DEVICE

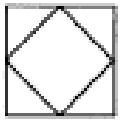
AUXILIARY PANEL
FRONT DEVICE



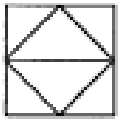
INTERNAL AUXILIARY
PANEL DEVICE



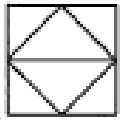
DEVICE INTEGRAL TO
ONE PANEL MOUNTED
DEVICE



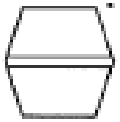
PLC I/O



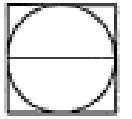
PLC I/O AND
ACCESSIBLE ON
OIT AND SCADA



PLC I/O AND
ACCESSIBLE ON OIT



METROTEL I/O



VFD HUMAN
INTERFACE MODULE
OR
MCC HUMAN
MACHINE INTERFACE

* HIM

HMI

VFD HUMAN
INTERFACE MODULE
OR
MCC HUMAN
MACHINE INTERFACE

Photo caption

Header

PLC INTERFACES

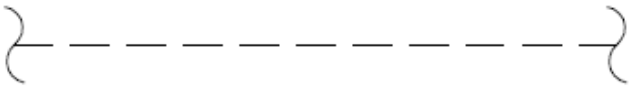
△ ANALOG INPUT
▽ ANALOG OUTPUT

(Analog = continuous)

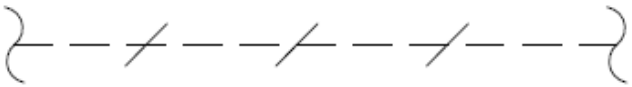
▲ DISCRETE INPUT
▼ DISCRETE OUTPUT

(Discrete = on/off)

☐ CABLE CONNECTION



ANALOG SIGNAL LINE



DISCRETE SIGNAL LINE

NETWORK CABLE

Photo caption

Instrumentation Identification

FIRST LETTER			SUCCEEDING LETTERS		
MEASURED OR INITIATING VARIABLE		MODIFIER	READOUT OR PASSIVE FUNCTION	OUTPUT FUNCTION	MODIFIER
A	ANALYSIS		ALARM	ALARM	AUTO
B	BURNER FLAME		USER'S CHOICE	USER'S CHOICE	USER'S CHOICE
C	CONDUCTIVITY (ELECTRICAL)			CONTROL	CLOSED
D	DENSITY (MASS) OR SPECIFIC GRAVITY	DIFFERENTIAL			FAIL, ERROR ABNORMAL
E	VOLTAGE (EMF)		PRIMARY ELEMENT		
F	FLOW RATE	RATIO (FRACTION)			
G	GAUGING (DIMENSIONAL)		GLASS		READY
H	HAND (MANUALLY INITIATED)				HIGH
I	CURRENT (ELECTRICAL)		INDICATE		
J	POWER	SCAN			RUNNING, RUN
K	TIME OR TIME SCHEDULE	TIME RATE OF CHANGE		CONTROL STATION	STOP
L	LEVEL		LIGHT (PILOT)		LOW, LOCAL
M	MOTOR OR MOISTURE	MOMENTARY			MID
N	EQUIPMENT				
O	USER'S CHOICE		ORIFICE (RESTRICTION)		OPEN
P	PRESSURE OR VACUUM		POINT (TEST CONNECTION)		
Q	QUANTITY	INTEGRATE OR TOTALIZE			
R	RADIATION		RECORD OR PRINT		REMOTE
S	SPEED OR FREQUENCY	SAFETY		SWITCH	
T	TEMPERATURE			TRANSMIT	
U	MULTIVARIABLE		MULTIFUNCTION	MULTIFUNCTION	MULTIFUNCTION
V	VIBRATION			VALVE, DAMPER, OR LOUVER	
W	TORQUE, WEIGHT, FORCE		WELL		
X	UNCLASSIFIED		PLC INPUT	UNCLASSIFIED	
Y	EVENT			RELAY OR COMPUTER OR PLC OUTPUT	
Z	POSITION			DRIVE, ACTUATE OR UNCLASSIFIED FINAL CONTROL ELEMENT	

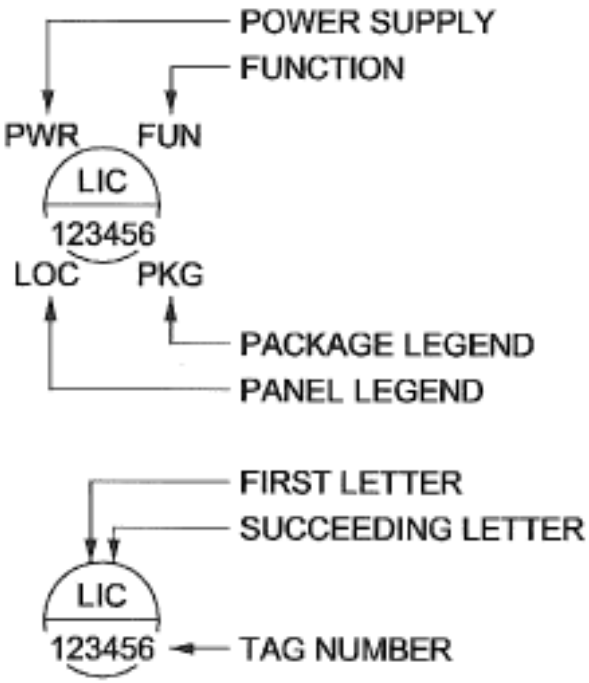


Photo caption

An Example

Alki CSO Treatment Plant
Sodium Hypochlorite System

INSTRUMENT ELEMENT , PIPING, VALVE AND EQUIPMENT SYMBOLS LEGEND

PRIMARY ELEMENT

- ORIFICE PLATE
- VENTURI OR FLOW TUBE
- NOZZLE FLOW
- PITOT TUBE
- PROPELLER OR TURBINE METER
- FLUME
- WEIR
- VARIABLE AREA FLOW INDICATOR (ROTAMETER)
- DIAPHRAGM SEAL
- IN-LINE ANNULAR SEAL
- FLOW ELEMENT INTEGRAL WITH TRANSMITTER (MASS FLOW, ETC)
- CAMERA (CCTV)
- MAGNETIC FLOWMETER
- SONIC FLOWMETER (DOPPLER OR TRANSIT TIME)
- POSITIVE DISPLACEMENT METER
- THERMAL FLOW ELEMENT
- VORTEX FLOW ELEMENT
- CORIOLIS FLOW ELEMENT
- FLOAT LEVEL ELEMENT
- ULTRASONIC FLOW ELEMENT
- RADAR OR ULTRASONIC LEVEL ELEMENT
- ANNUBAR
- BUBBLER LEVEL TUBE
- SUBMERSIBLE LEVEL TRANSMITTER
- COMPENSATED FLOW METER

PIPELINE DEVICES

- TRAP
- SEDIMENT TRAP
- GAS DRIP TRAP
- SEPARATOR/ DRYER
- PIPELINE FILTER
- RUPTURE DISK (VACUUM RELIEF)
- RUPTURE DISK (PRESSURE RELIEF)
- CONNECTION BETWEEN NEW AND EXISTING PIPING
- UNION
- QUICK CONNECTOR
- CAP OR PLUG
- BLIND FLANGE
- HOSE CONNECTION
- REDUCER
- TEE
- FLEX CONNECTION
- VENT TO ROOF
- VENT
- STEAM VENT
- AUTOMATIC VENT
- MANUAL VENT
- STRAINERS
- DRAIN
- DRAIN VALVE
- CALIBRATION CHAMBER
- PULSATION DAMPENER
- INJECTOR
- FLAME TRAP
- FLAME TRAP WITH THERMO SHUTOFF ASSEMBLY
- FLAME CHECK
- SAMPLING AND FLUSHING CONNECTIONS
- SUCTION DIFFUSER
- TEMPERATURE WELL
- FLOW STRAIGHTENING VANES
- PRESSURE REDUCING ASSEMBLY
- AMMONIA UNION
- DAMPER
- SIGHT GLASS
- PIG LAUNCHER/ RECEIVER
- REDUCED PRESSURE BACKFLOW PREVENTER
- FUEL PIPING LEAK DETECTOR ELEMENT
- FOOT VALVE
- AIR SEPARATOR
- SIGHT GLASS
- PRESSURE INDICATOR

VALVES AND GATES

NORMALLY OPEN / NORMALLY CLOSED

- GATE VALVE
- PLUG VALVE
- BALL VALVE
- GLOBE VALVE
- NEEDLE VALVE
- KNIFE GATE VALVE
- DIAPHRAGM VALVE
- BUTTERFLY VALVE
- ANGLE VALVE
- THREE WAY VALVE
- FOUR WAY VALVE
- FLOAT VALVE
- PINCH VALVE
- BALANCING COCK
- THERMOSTATICALLY CONTROLLED VALVE
- DOUBLE LEAF CHECK VALVE
- CHECK VALVE
- BALL CHECK VALVE
- PUMP DISCHARGE VALVE
- GAUGE OR ROOT VALVE
- PRESSURE AND VACUUM RELIEF VALVE
- VACUUM RELIEF VALVE
- PRESSURE RELIEF VALVE
- IN-LINE, SPRING LOADED RELIEF VALVE
- PRESSURE REGULATING VALVE (SELF-CONTAINED)
- BACK PRESSURE REGULATING VALVE (SELF-CONTAINED)
- FUSIBLE LINK
- SOLENOID VALVE
- DIAPHRAGM OPERATED VALVE
- PRESSURE BALANCE OPERATED VALVE
- MOTOR OPERATED VALVE
- MOTOR OPERATED VALVE, MODULATING

NOTE:
USE VALVE BODY SYMBOL TO MATCH TYPE OF VALVE.

- PISTON OPERATED VALVE
- TELESCOPING VALVE
- MUD VALVE

SLIDE AND SLUICE GATES

- FLAP GATE
- BUTTERFLY GATE
- STOP GATE (NORMALLY OPEN)
- STOP GATE (NORMALLY CLOSED)
- SLIDE GATE (NORMALLY OPEN)
- SLIDE GATE (NORMALLY CLOSED)
- SLUICE GATE (NORMALLY OPEN)
- SLUICE GATE (NORMALLY CLOSED)

EQUIPMENT

PUMPS

- PUMP, CENTRIFUGAL
- PUMP, DIAPHRAGM
- PUMP, GEAR
- PUMP, METERING
- PUMP, PERISTALTIC
- PUMP, PROGRESSING CAVITY
- PUMP, ROTARY LOBE
- PUMP, SUBMERSIBLE
- PUMP, VERTICAL

BLOWERS AND COMPRESSORS

- BLOWER OR CENTRIFUGAL FAN
- BLOWER OR COMPRESSOR, LIQUID RING
- BLOWER OR COMPRESSOR, ROTARY LOBE
- COMPRESSOR, ROTARY SCREW
- COMPRESSOR, ROTARY SLIDING VANE
- COMPRESSOR, PISTON

MIXERS

- MIXER
- MIXER, INLINE STATIC

SCREENINGS AND CONVEYORS

- SCREEN
- SCREEN, ROTARY OVERFLOW
- CLASSIFIER OR GRIT WASHER
- CONVEYOR
- HYDROCYCLONE
- SCREENINGS PRESS

VESSELS AND TANKS

- RECEIVER OR PRESSURE VESSEL
- TANK, DOUBLE WALLED
- TANK, NON-PRESSURE TYPE

MOTORS AND POWER

- VFD
- VSD — VARIABLE SPEED DRIVE (DC)
- S — SOLENOID
- M — MOTOR
- ENGINE
- EJECTOR, PNEUMATIC
- GENERATOR
- SPEED SENSOR (RPM)

HEAT EXCHANGERS

- SHELL AND TUBE HEAT EXCHANGER
- HEAT EXCHANGER, PLATE TYPE
- HEAT EXCHANGER, SPIRAL TYPE
- HEAT EXCHANGER, STRAIGHT TUBE TYPE
- HEAT EXCHANGER, U-TUBE TYPE

HVAC RELATED

- FAN, INLINE
- CHILLER
- FILTER OR FILTER-SILENCER, INLET AIR
- BOILER

MISCELLANEOUS

- SILENCER
- GREASE FILTER/DEMISTER
- BURNER, WASTE GAS
- HEAT TRACE
- GRINDER
- DIFFUSER HEADER
- SPRAY NOZZLES
- HOPPER
- OR

NO	REVISION DESCRIPTION	BY	APVD	DATE

DESIGNED/DRAWN: R E WARD	CHECKED:
PROJECT ENGINEER: R E WARD	SCALE: AS NOTED
DESIGN APPROVAL:	FACILITY NUMBER: ALL
PROJECT ACCEPTANCE: S. MINGUS	CONTRACT NO: C01184C17

King County

DEPARTMENT OF NATURAL RESOURCES & PARKS
WASTEWATER TREATMENT DIVISION
ALKI WET WEATHER TREATMENT FACILITY
HYPOCHLORITE PUMP REPLACEMENT

PROCESS
INSTRUMENT ELEMENT, PIPING, VALVE, & EQUIPMENT SYMBOLS

DATE: JULY 2017
PROJECT FILE NO: 16-1128126
DRAWING NO: **P002**
SHT NO: 22 / TOTAL: 40
REV NO: **0**

CONTROL SCHEMATIC SYMBOLS

- CONNECTION POINT
- NORMALLY OPEN CONTACT
- NORMALLY CLOSED CONTACT
- EARTH GROUND
- CHASSIS GROUND
- TRANSIENT SUPPRESSOR
- CAPACITOR
- RESISTOR
- VARIABLE RESISTOR
- POTENTIOMETER
- THERMAL OVERLOAD ELEMENT
- CIRCUIT BREAKER
- TRANSFORMER
- POTENTIAL TRANSFORMER
- DELTA TRANSFORMER CONNECTION
- WYE TRANSFORMER CONNECTION
- LINE REACTOR
- XX AMP TYPE YY — FUSE; XX INDICATES AMPERE RATING; YY INDICATES FUSE TYPE
- BLOWN FUSE INDICATOR
- BUS STAB
- BATTERIES
- P — PURGE UNIT OR LEVEL SYSTEM BUBBLER ASSEMBLY
- I — CONTROL CIRCUIT INTERLOCK OR INTERFACE

CONTROL SCHEMATIC SYMBOLS

- LIMIT SWITCH NORMALLY OPEN CONTACT ACTUATED (HELD) CLOSED
- LIMIT SWITCH NORMALLY CLOSED CONTACT CONTACT OPENS WHEN ACTUATED
- LIMIT SWITCH NORMALLY CLOSED CONTACT ACTUATED (HELD) OPEN
- LIMIT SWITCH NORMALLY OPEN CONTACT CONTACT CLOSES WHEN ACTUATED
- NORMALLY CLOSED PRESSURE SWITCH CONTACT OPENS ON INCREASING PRESSURE
- NORMALLY OPEN PRESSURE SWITCH CONTACT CLOSES ON DECREASING PRESSURE
- NORMALLY OPEN PRESSURE SWITCH CONTACT CLOSES ON INCREASING PRESSURE
- NORMALLY OPEN FLOAT SWITCH CONTACT CLOSES ON FALLING LEVEL
- NORMALLY OPEN FLOAT SWITCH CONTACT CLOSES ON RISING LEVEL
- NORMALLY CLOSED FLOW SWITCH OPENS ON INCREASING FLOW
- NORMALLY OPEN FLOW SWITCH CONTACT CLOSES ON INCREASING FLOW
- NORMALLY OPEN TEMP SWITCH CONTACT CLOSES ON RISING TEMP
- NORMALLY CLOSED TEMP SWITCH CONTACT OPENS ON RISING TEMP
- NORMALLY OPEN TEMP SWITCH CONTACT CLOSES ON FALLING TEMP
- TIME DELAY RELAY CONTACT DELAY ON ENERGIZING NORMALLY OPEN TIMED CLOSE CONTACT
- TIME DELAY RELAY CONTACT DELAY ON ENERGIZING NORMALLY CLOSED TIMED OPEN CONTACT
- TIME DELAY RELAY CONTACT DELAY ON DEENERGIZING NORMALLY CLOSED TIMED CLOSED CONTACT
- TIME DELAY RELAY CONTACT DELAY ON DEENERGIZING NORMALLY OPEN TIMED OPEN CONTACT

CONTROL SCHEMATIC SYMBOLS

- SOLENOID VALVE
- CABLE SHIELD
- A — INDICATING PILOT LIGHT; LETTER INDICATES COLOR OF LENS
- X — SINGLE PHASE MOTOR; X INDICATES HORSEPOWER
- HP — THREE PHASE MOTOR; HP INDICATES HORSEPOWER
- CRXXX / CR — CONTROL RELAY OPERATING COIL; XXX = RELAY NUMBER
- TDR-YYY / XX / ZZZ — TIME DELAY RELAY; ZZZ = TIME RANGE; XX=DE FOR DELAY ON ENERGIZATION; XX=DO FOR DELAY ON DEENERGIZATION; YYY = RELAY NUMBER
- DISCONNECT OR TOGGLE SWITCH
- TOGGLE SWITCH
- H A X X X — THREE POSITION SELECTOR SWITCH CONTACTS CLOSED IN POSITION INDICATED BY "X"; NUMBER OF ELECTRICAL CONTACTS ON SWITCH SHOWN ON CONTROL SCHEMATIC
- NORMALLY OPEN MOMENTARY CIRCUIT CLOSING PUSHBUTTON SWITCH SPRING OPEN; NUMBER OF ELECTRICAL CONTACTS ON SWITCH SHOWN ON CONTROL SCHEMATIC
- NORMALLY CLOSED MOMENTARY CIRCUIT OPENING PUSHBUTTON SWITCH SPRING CLOSE; NUMBER OF ELECTRICAL CONTACTS ON SWITCH SHOWN ON CONTROL SCHEMATIC
- PUSHBUTTON LOCKOUT STOP
- FIELD CONTACT

CONTROL RELAYS

- 2 / CR / FUNCTION — OPERATING COIL; CR = CONTROL RELAY, U = UNLATCH, L = LATCH
- OL — SOLID STATE OVERLOAD RELAY
- CR2 (LINE) CR2 (LINE) — OUTPUT CONTACTS. LINE NUMBER OF RELAY COIL SHOWN (OPTIONAL)

TIMING RELAYS

- TR 3 — OPERATING COIL; ON or OFF DELAY; RANGE:SEC/MIN; SET:SEC/MIN
- NORMALLY OPEN / NORMALLY CLOSED — (LINE) OR TC — TR3 (LINE) OR TO — DELAY ON COIL ENERGIZATION (ON DELAY)
- (LINE) OR TO — TR3 (LINE) OR TC — DELAY ON COIL DE-ENERGIZATION (OFF DELAY)

CONTACTORS

- ID / C — OPERATING COILS; C = CONTACTOR, LIGHTING OR GENERAL USE; F = FAST OR FORWARD; M = MAIN OR LINE; 1M = FIRST MAIN OR WYE; 2M = SECOND MAIN OR DELTA; R = RUN OR REVERSE; S = SLOW OR START
- ID / SIZE — MAIN CONTACTS

OUTPUT LOADS AND DEVICES

- M — MOTOR
- SPACE HEATER, WATTAGE SHOWN
- MAGNETIC COIL
- SV — SOLENOID
- ETM — HOUR METER (ELAPSED TIME)
- KIC — TIME CONTROLLER

GENERAL NOTES:

1. THIS DRAWING IS GENERAL IN NATURE. SOME SYMBOLS SHOWN HEREON MAY NOT BE USED ON THE CONTRACT DRAWINGS.
2. SYMBOLS ARE ARRANGED ON SPECIFIC DRAWINGS AND IN CATEGORIES FOR CONVENIENCE ONLY; SYMBOLS MAY BE USED ON ANY OF THE CONTRACT DRAWINGS.
3. IDENTIFICATIONS (ID), SIZES, RATINGS, LOCATIONS AND SIMILAR INFORMATION SHOWN ASSOCIATED WITH SYMBOLS ARE OPTIONAL. EXAMPLES OF SUCH INFORMATION ARE SHOWN WITH SOME SYMBOLS FOR CLARITY.

NO.	REVISION DESCRIPTION	BY	APVD	DATE

DESIGNED/DRAWN: B. HOKENSON	CHECKED: R. WARD
PROJECT ENGINEER: E. DIZDAREVIC	SCALE: NO SCALE
DESIGN APPROVAL: R. BROWNE	FACILITY NUMBER: 400
PROJECT ACCEPTANCE: S. MINGUS	CONTRACT NO: C01184C17

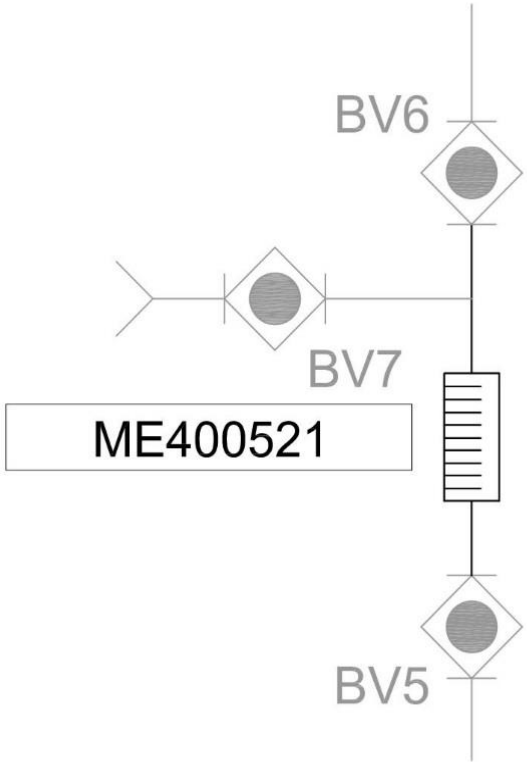
King County

DEPARTMENT OF NATURAL RESOURCES & PARKS
WASTEWATER TREATMENT DIVISION
ALKI WET WEATHER TREATMENT FACILITY
HYPOCHLORITE PUMP REPLACEMENT

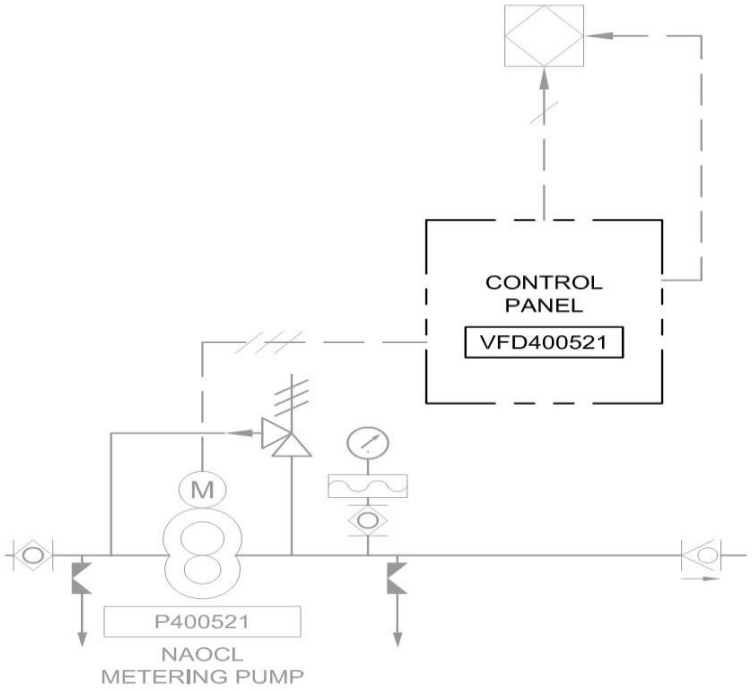
INSTRUMENTATION LEGEND AND SYMBOLS

DATE:	JULY 2017
PROJECT FILE NO:	16-1128126
DRAWING NO:	I001
SHT NO / TOTAL	24 / 40
REV NO:	0

Examples

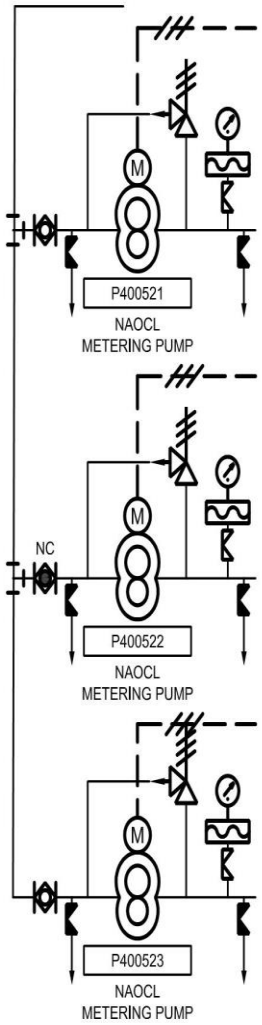


Examples

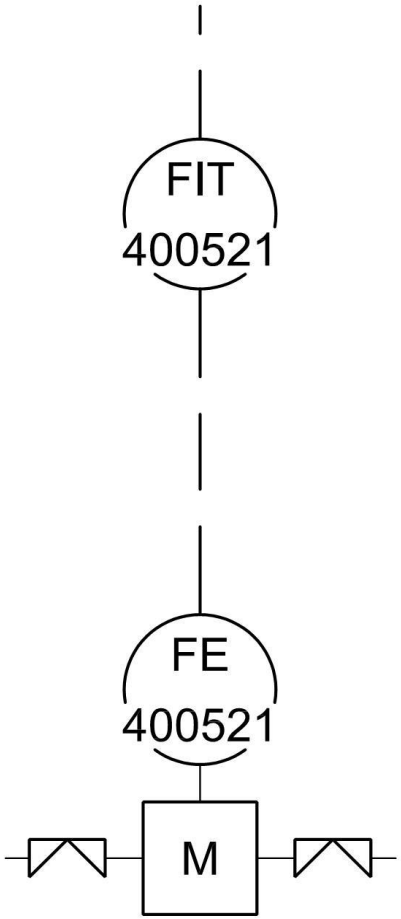

CONTROL
PANEL
VFD400521
M
P400521
NAOCL
METERING PUMP


Rockwell
Automation
DANGER

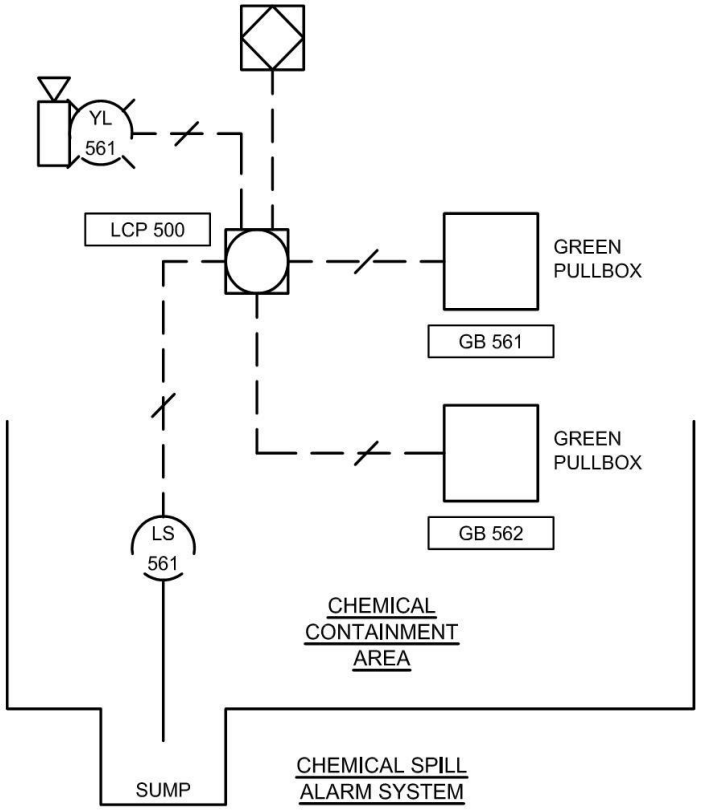
Examples


M
P400521
NAOCL
METERING PUMP
NC
M
P400522
NAOCL
METERING PUMP
M
P400523
NAOCL
METERING PUMP

Examples

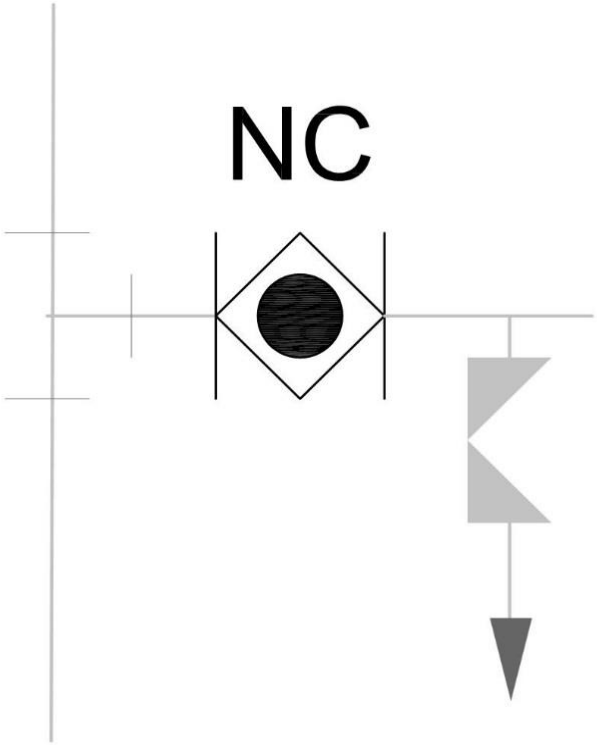


Examples

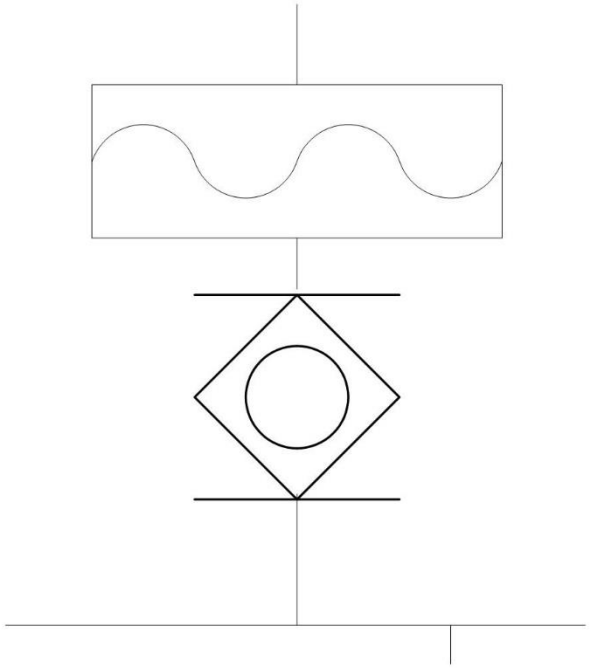

YL
561
LCP 500
GREEN
PULLBOX
GB 561
GREEN
PULLBOX
GB 562
LS
561
CHEMICAL
CONTAINMENT
AREA
SUMP
CHEMICAL SPILL
ALARM SYSTEM


LCP-500
CHEMICAL ALARM &
LEVEL INDICATOR PANEL
CHEMICAL
MIXING START
TECHNICAL SYSTEMS INC.

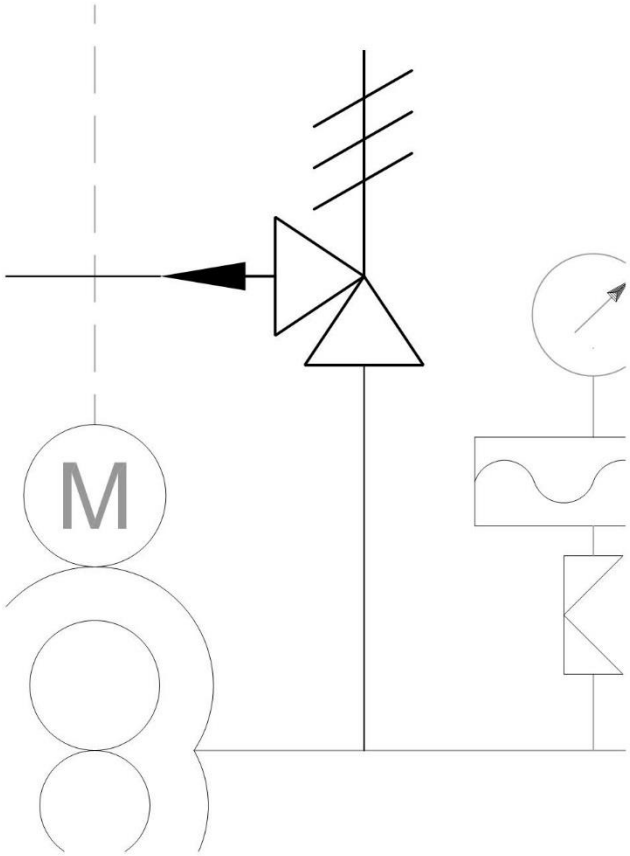
Examples



Examples

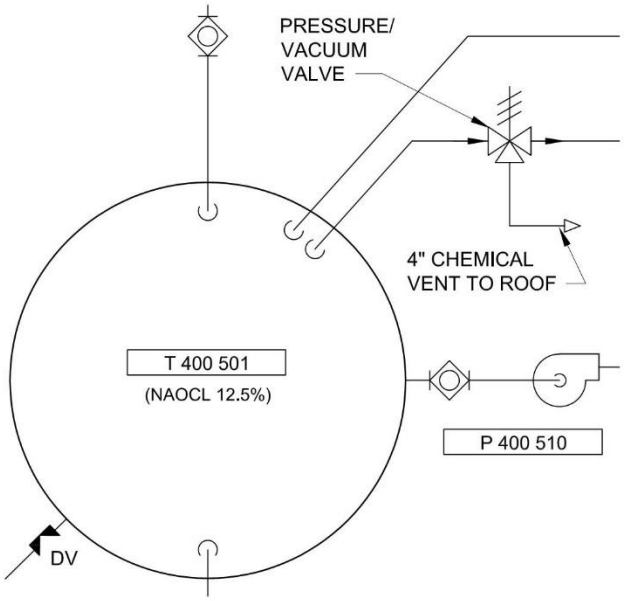


Examples


M

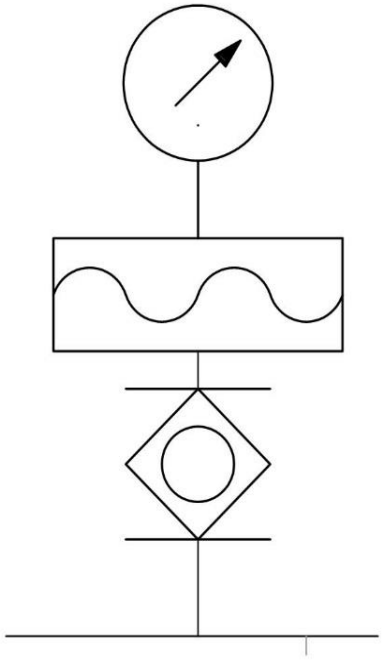

PRV
400,523
PRESSURE RELIEF VALVE
Product Code: PRG2075PTV
Rating: 10 – 150 psi
Set: 50
Serial # 2155349
Flow
Griffco Valve Inc.
Amherst, NY U.S.A.
1 800 GRIFFCO
Made in USA

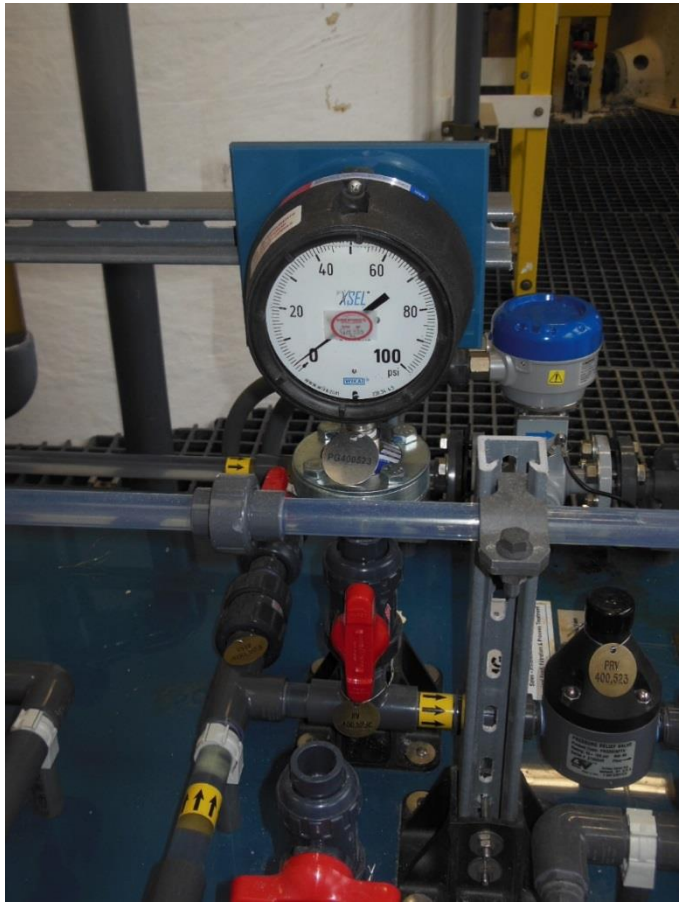
Examples


PRESSURE/
VACUUM
VALVE
4" CHEMICAL
VENT TO ROOF
T 400 501
(NAOCL 12.5%)
P 400 510
DV

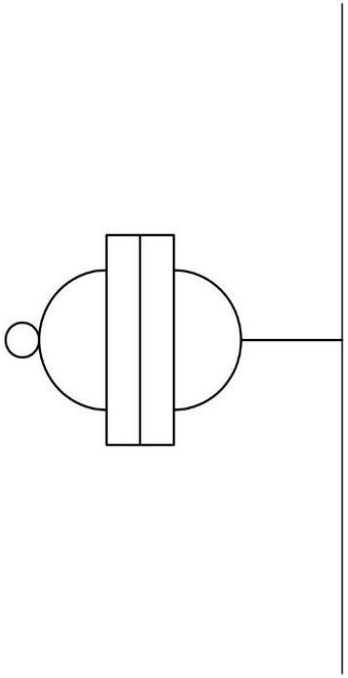

SODIUM HYPOCHLORITE
12½%
3,000 GAL

Examples

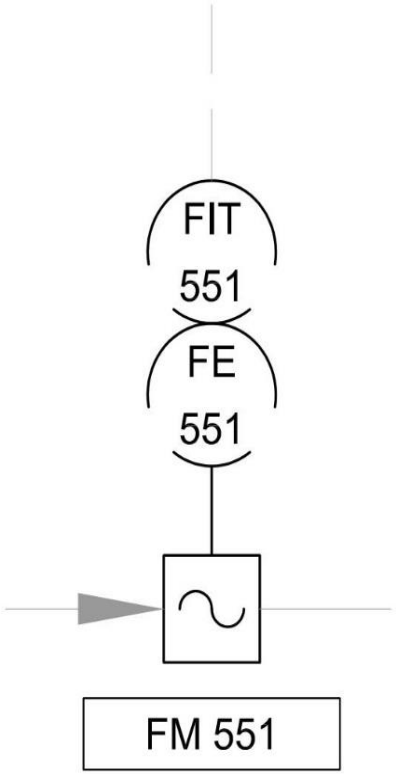




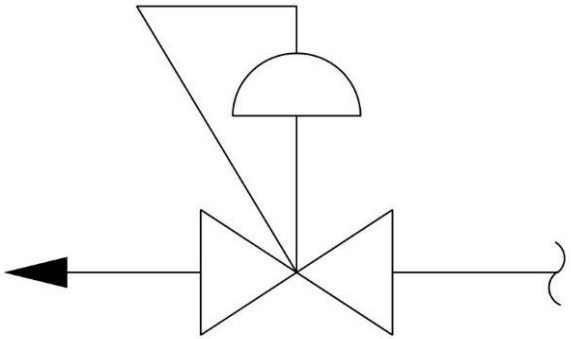
Examples



Examples

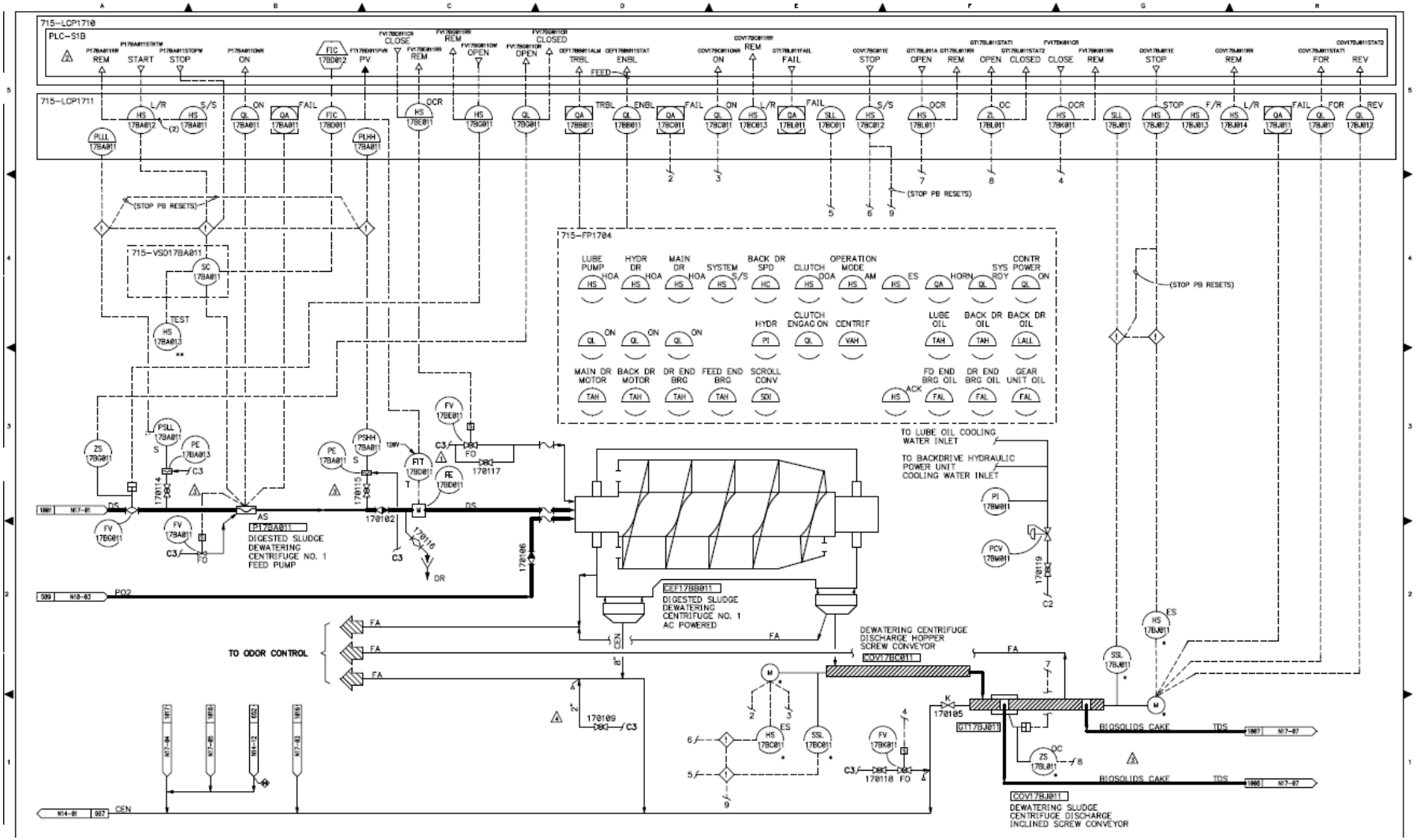


Examples

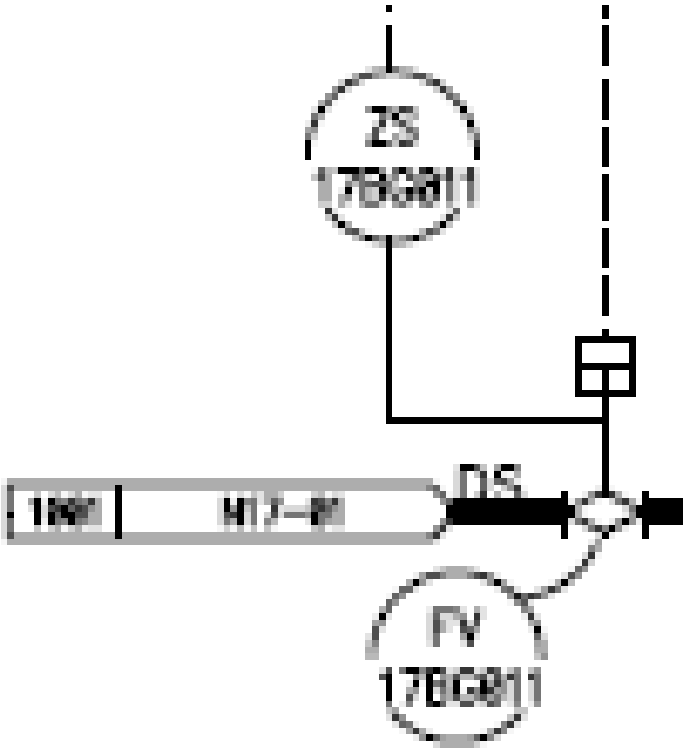



BREAK
TIME

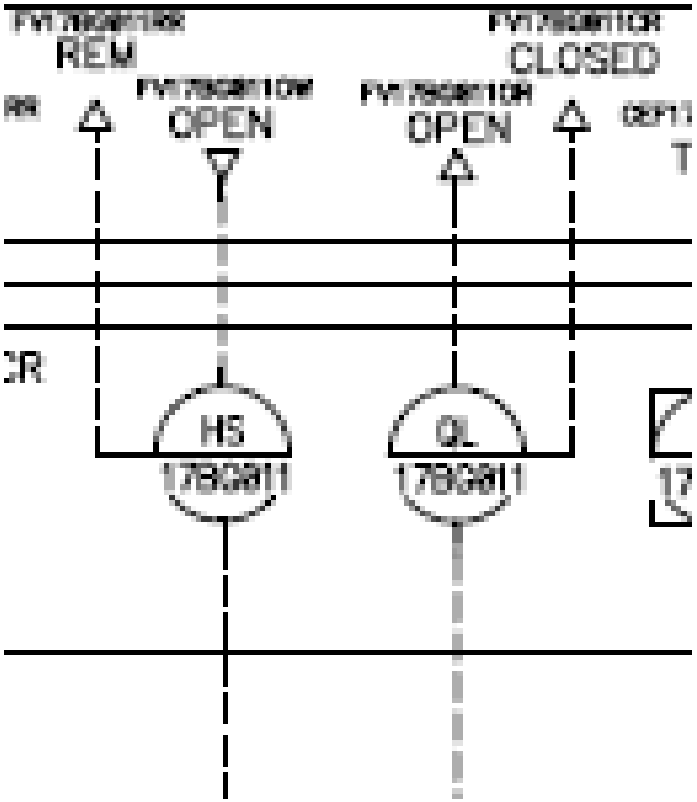
Sludge Dewatering Centrifuge No.1



FV 17BG011

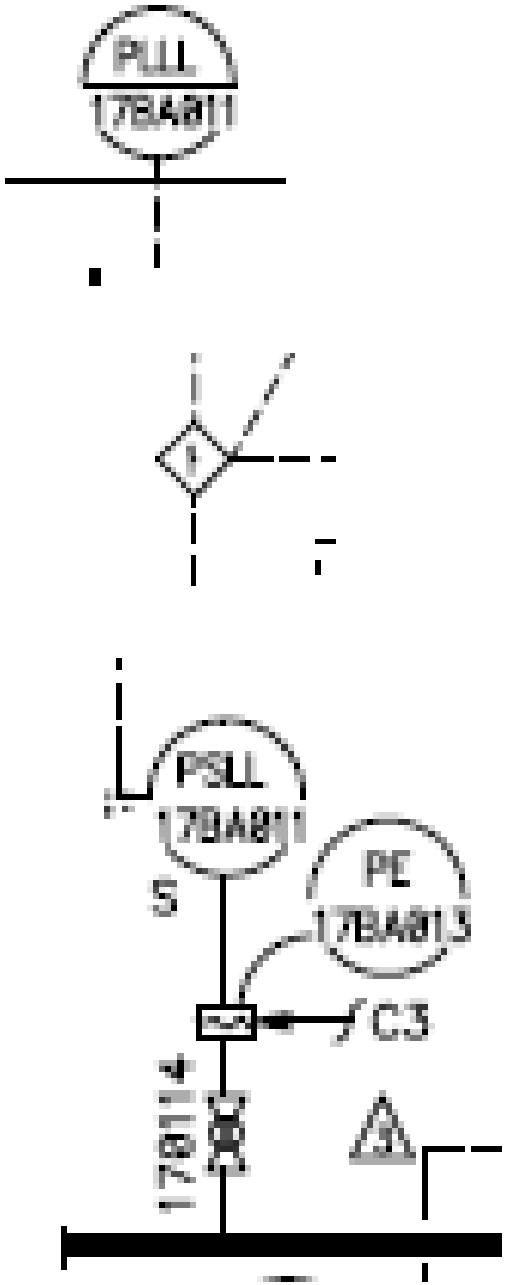


FV 17BG011


REM
CLOSED
OPEN
OPEN
HS
17BG011
QL
17BG011

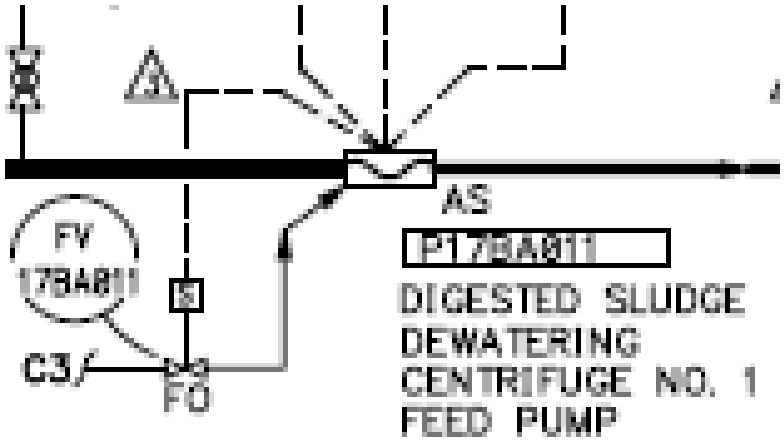

CLOSE
OPEN
CLOSE
REMOTE
SLUDGE DEWATERING
CENTRFG NO. 1 FEED
PUMP SUCTION VALVE
FV17BG011

PE 17B013

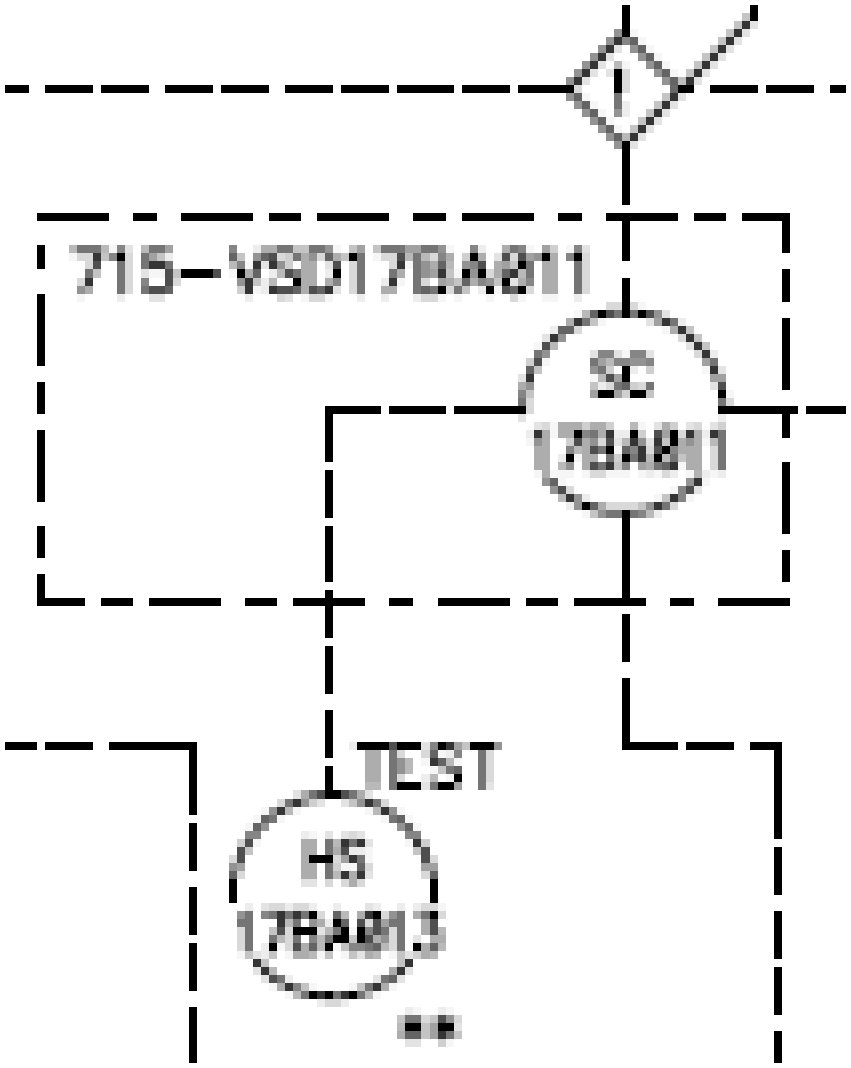

PSLL
17BA811
PSLL
17BA811
S
PE
17BA813
C3
17B114


LOW-LOW
PRESSURE
HIGH-HIGH
PRESSURE
ON
START
STOP
DIGESTED SLUDGE
DEWATERING OFF

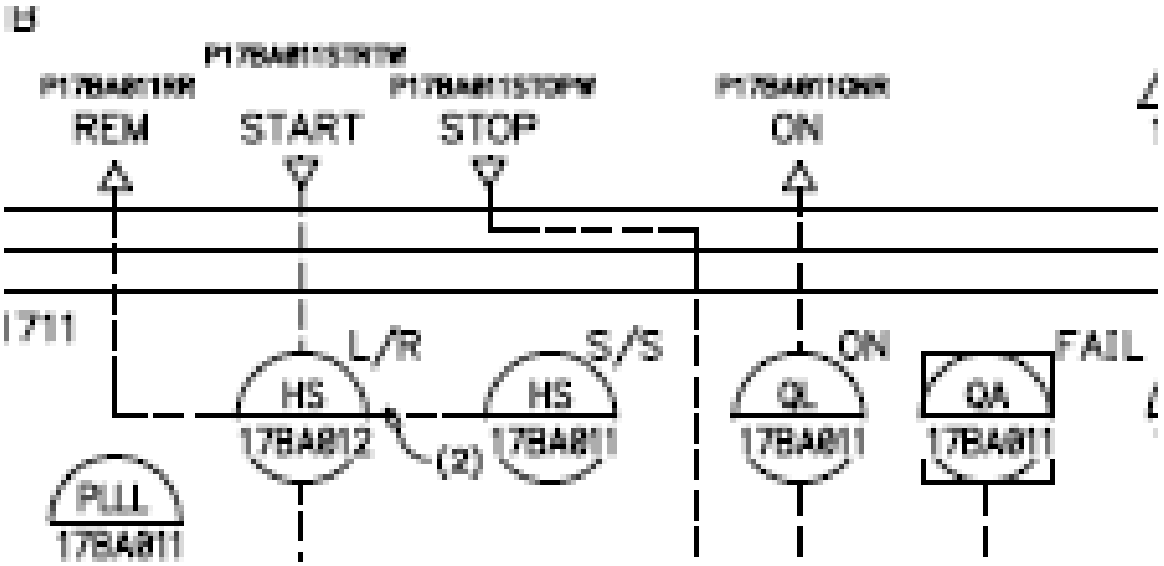
FV17BA011 / P17BA011



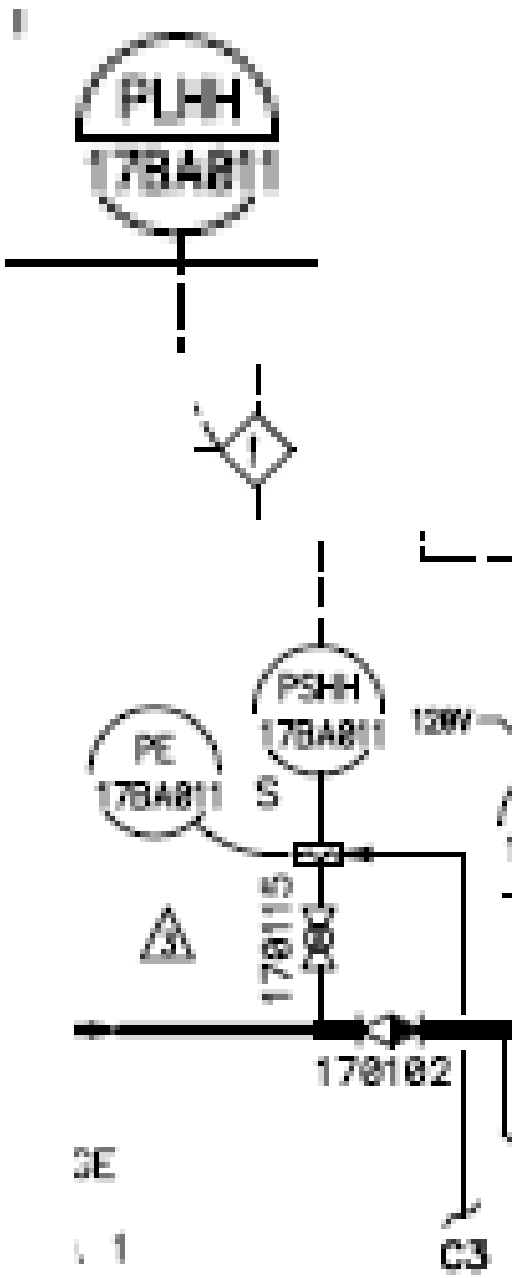
FV17BA011 / P17BA011



FV17BA011 / P17BA011



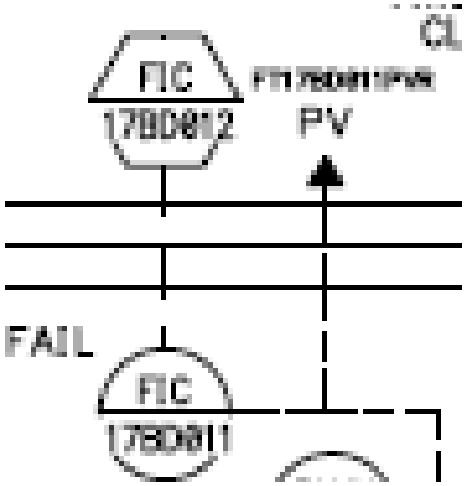
PE 17BA011

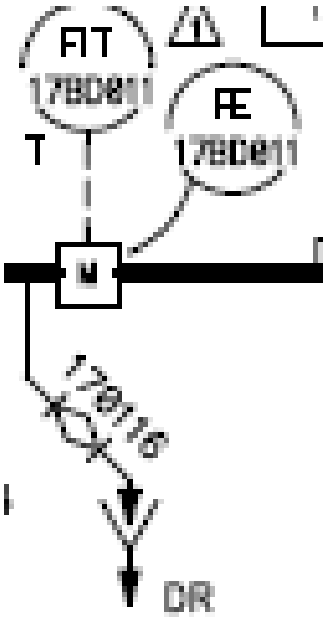

PLHH
17BA811
PSHH
17BA811
120V
PE
17BA811
S
170102
C3


ON
LOW-LOW
PRESSURE
HIGH-HIGH
PRESSURE
START
STOP
DIGESTED SLUDGE
DEWATERING CEF
FEED PUMP 1

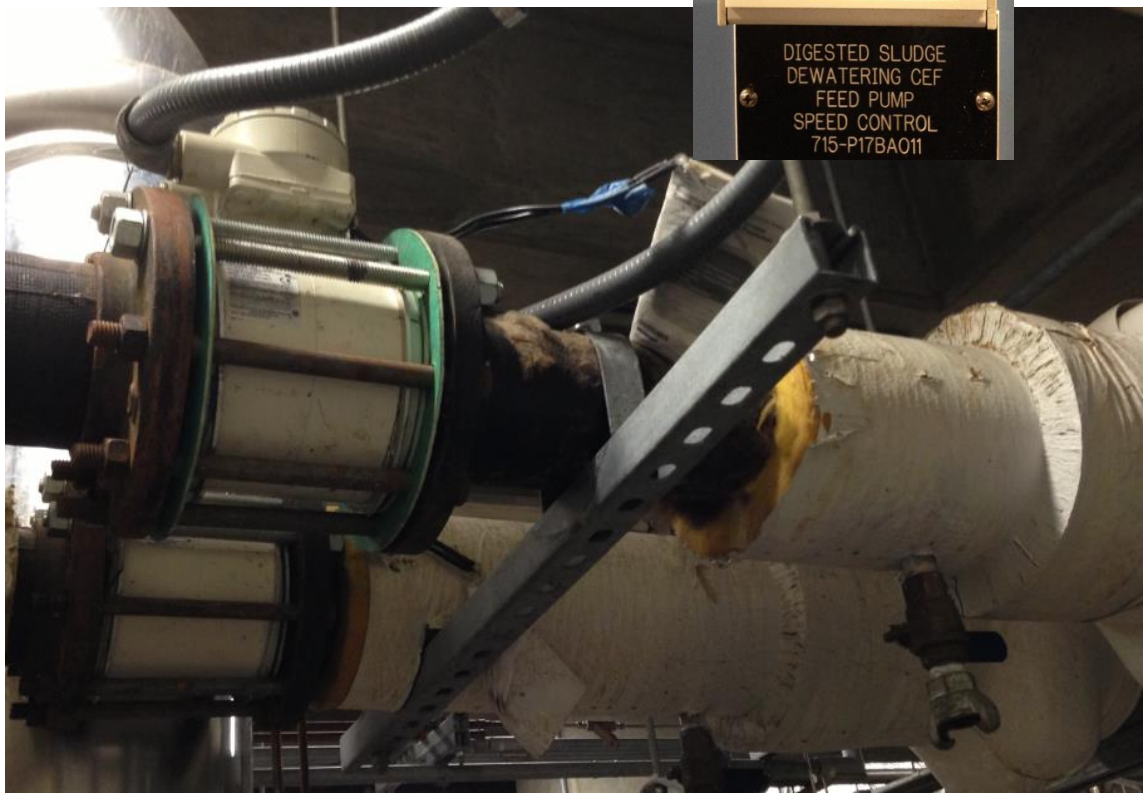

WARNING

FE 178D011

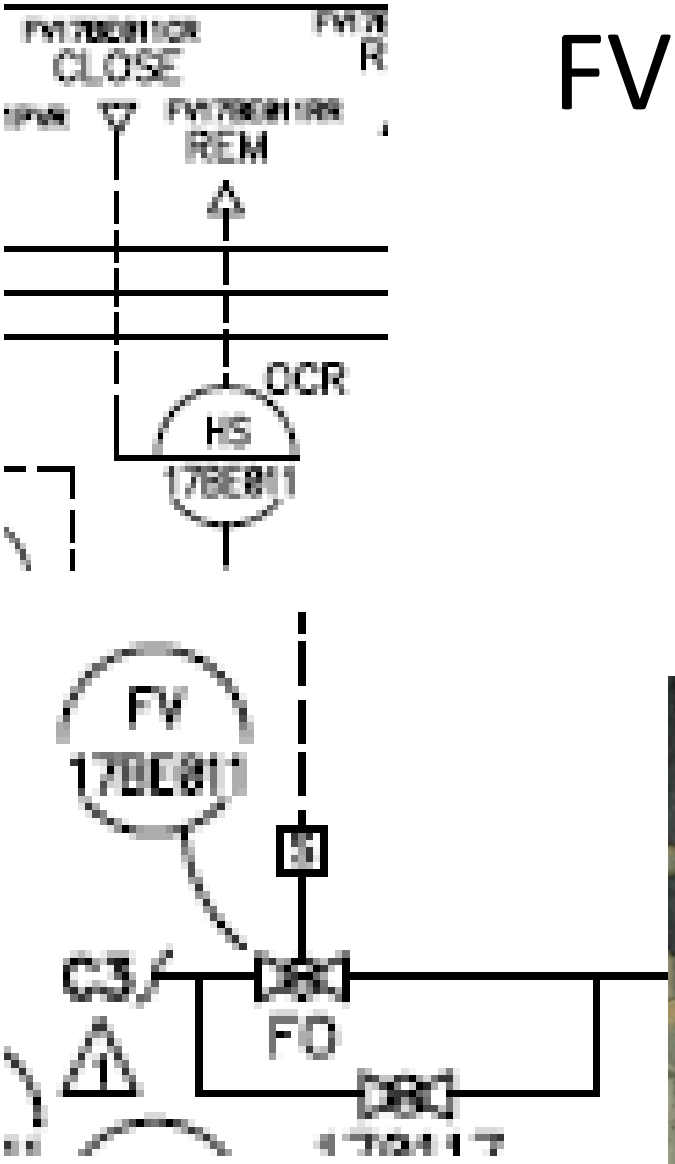

FIC
178D012
PV
FAIL
FIC
178D011


FIT
178D011
FE
178D011
T
M
DR


MOORE
0.3
CL
EI
AM
D
ACK
CLOSE
OPEN
DIGESTED SLUDGE
DEWATERING CEF
FEED PUMP
SPEED CONTROL
715-P17BA011

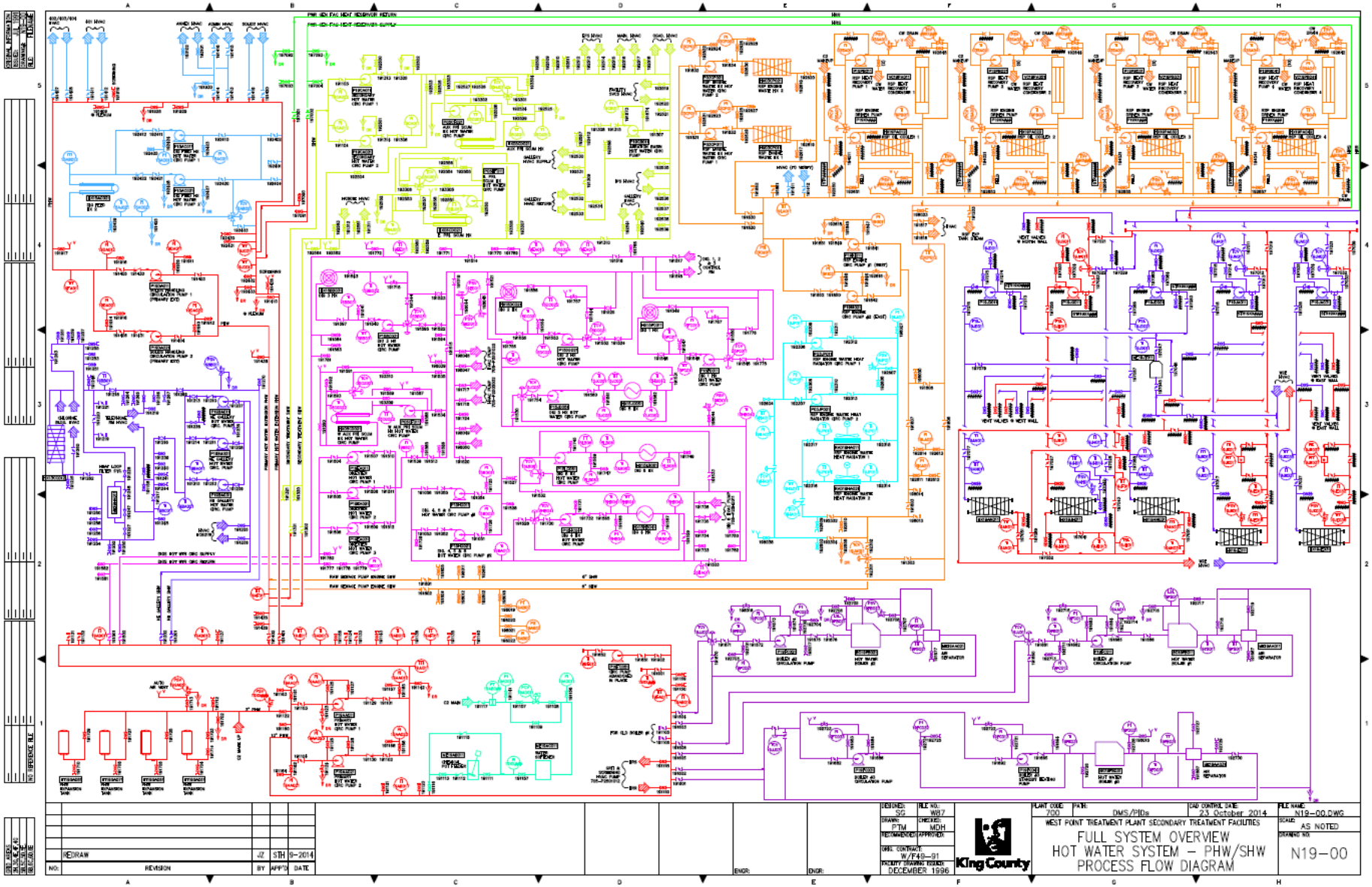


FV 178B011


CLOSE
REM
OCR
HS
FV
C3
FO


FLUSH
CLOSE
OPEN
REM
DIGESTED SLUDGE
DEWATERING CEF
C3 FLOW VALVE


DANGER
ARC FLASH HAZARD
DANGEROUS
DANGER
HIGH VOLTAGE
DANGER
HIGH VOLTAGE
WARNING
ARC FLASH HAZARD
DANGER



NO:	REVISION	BY	APP'D	DATE
	REDRAW	JZ	STH	9-2014

DESIGNED: SG	FILE NO.: W87
DRAWN: PTM	CHECKED: MDH
RECOMMENDED/APPROVED:	
DRG. CONTRACT: W/F49-91	
FACILITY DRAWING ISSUED: DECEMBER 1996	

King County

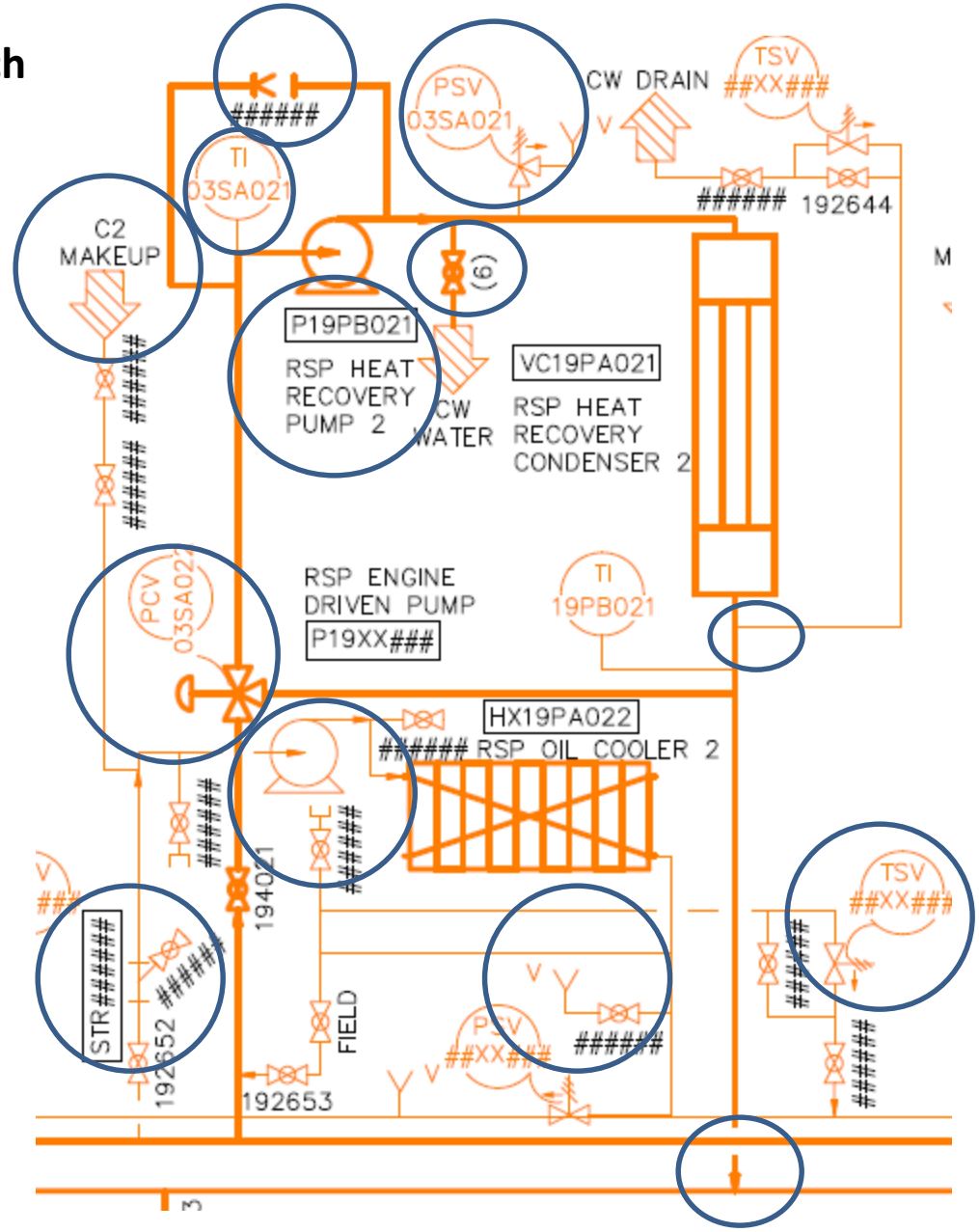
PLANT CODE: 700	PATH: DMS/PIDs	CAD CONTROL DATE: 23 October 2014

WEST POINT TREATMENT PLANT SECONDARY TREATMENT FACILITIES

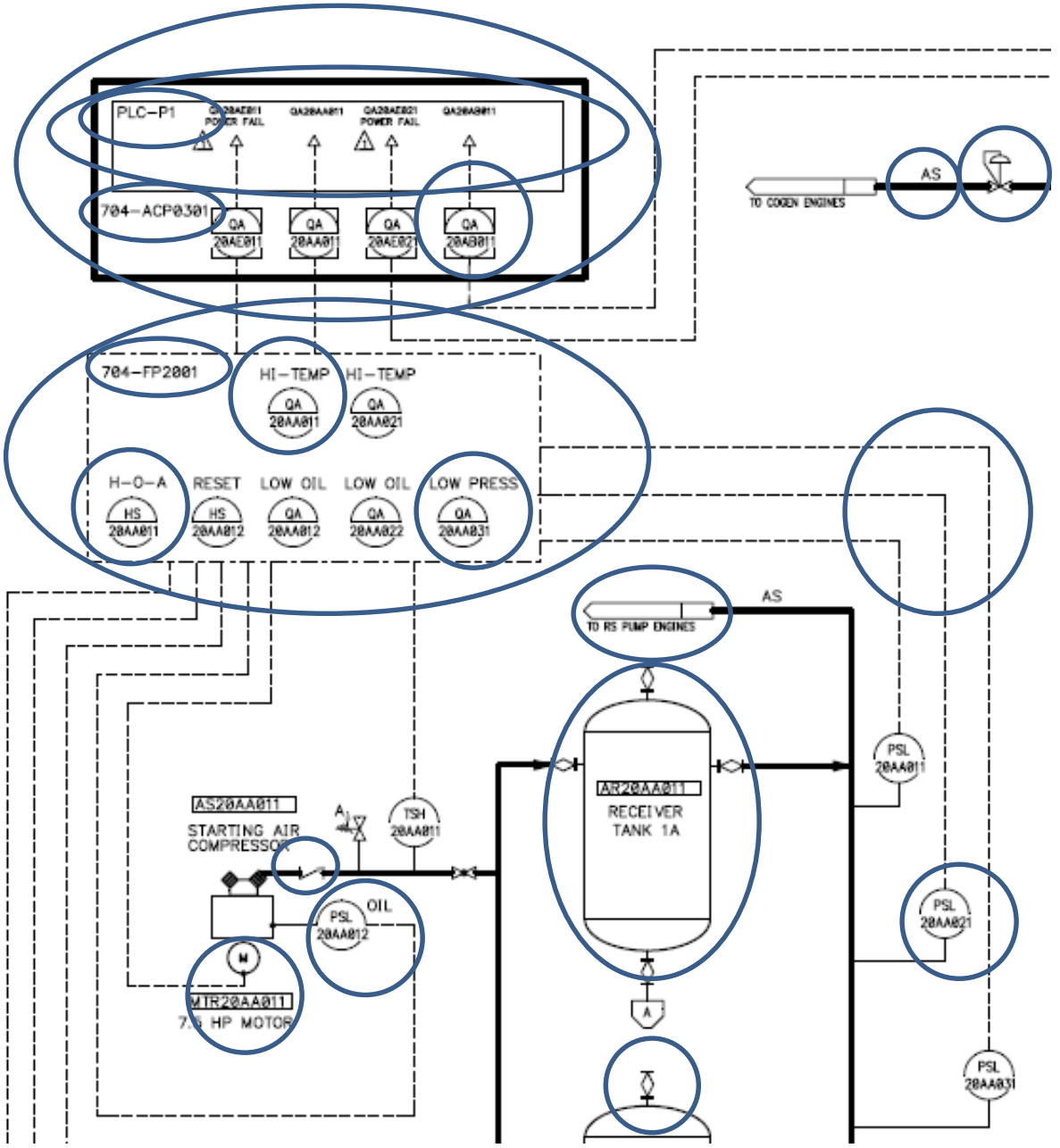
FULL SYSTEM OVERVIEW
HOT WATER SYSTEM – PHW/SHW
PROCESS FLOW DIAGRAM

FILE NAME: N19-00.DWG
SCALE: AS NOTED
DRAWING NO.: N19-00

Identify what is in each circle and which table is used to find the information



Identify what is in each circle and which table is used to find the information



Questions, Comments and Suggestions?

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kkihs@pnws-awwa.org

Loren Searl | TCC Chair
lsearl@lsearl@spokanecity.org

American Water Works Association
Pacific Northwest Section
Prepared by the Training Coordination Committee, PNWS-AWWA