

Mechanical Equipment - Course 430.1

IDENTIFICATION AND CODING OF MECHANICAL EQUIPMENT

Design, operation and maintenance of plant equipment requires the establishment and use of a system of positive identification of all systems, sub-systems and components in our plants.

A numbering system supplemented in the field by colour coding and tagging has been adopted. On flow sheets, a system of equipment symbols is used.

The numbering system is called USI - Uniform Subject Index. Although in principle it is identical in all our plants, it may vary in detail from station to station. In addition to mechanical equipment, USI specifies most of the equipment and activities in the plant. The subject index is sub-divided into Divisions. For example, at Bruce NGS, the Divisions are:

Division 0	General Project
Division 1	Site and Improvements
Division 2	Buildings, Structures and Shielding
Division 3	Reactor, Boiler and Auxiliaries
Division 4	Turbine, Generator and Auxiliaries
Division 5	Electric Power Systems
Division 6	Instrumentation and Control
Division 7	Common Processes and Services
Division 8	Construction Indirects

Each system, sub-system and component is assigned a five-digit number. An example from Division 4 explains the structure of USI:

Division	40000	Turbine, Generator and Auxiliaries
Major System	42000	Condensing System
System	42100	Main Condensing System
Sub-System	42120	Condenser Extraction System
Components	42121	Ejectors
	42122	Vacuum Pumps
	42123	Valves
	42128	Pipe Supports
	42129	Piping

So the first digit is indicative of a division, second of a major system in the division, third of a system within the major system, fourth of a sub-system in the system and finally the fifth digit classifies components in the sub-system.

In the field, the USI number accompanied by a brief written description is found either printed on the equipment or on a tag attached to the equipment.

Usually there is more than one component of the same kind within a sub-system, for example valves. To distinguish between identical components a letter code (P for pump, V for valve, etc) and a serial number is used to identify the particular component. This code, plus the serial number, is definitely found attached onto the component. Note that the letter code plus the serial number replaces the last digit which indicated the type of component in general.

For example,

4212V2

will be valve number two in the Condenser Extraction System.

On the flowsheets (system diagrams) pictorial symbols as well as USI numbers and letter symbols are used to achieve correspondence between the field and the documentation.

The letter symbols as well as pictorial symbols of various types of mechanical equipment are given in the Addendum with a complete Division 4 numbering system as an example. Also attached are two examples of flowsheets. All examples originate from Bruce NGS.

For quick field orientation, equipment and particularly piping is colour and letter coded so that it is immediately obvious what type of fluid is inside. Also an arrow is attached showing the direction of flow. The colours and code letters commonly used are:

Air	A	Blue
Heavy Water	D	Pink
Light (Common) Water	W	Green
Steam	S	Silver (Aluminum), White at BHWP
Oil	O	Yellow
Helium	H	Brown
Other Gases	G	Brown
Bldg. Heating		White
Drains		Black
Fire Protection		Red
Vacuum		Purple
Chemicals		Orange

To summarize, each system, sub-system and component is given a USI number. Each similar component is given a serial number. In the field, systems are colour coded according to the fluid carried in them and each component is labeled with its USI number and serial number. All documentation (manuals, flowsheets, etc) refers to components by their USI and serial numbers.

ASSIGNMENTS

1. How is a piece of equipment identified in the field?
2. How is a piece of equipment identified in a flowsheet?
3. The USI number is 71310. What can you say about the equipment labelled by that number?
4. There are three identical pumps in the system numbered as 43230 - Boiler Feed System. Write a complete identification of all three of them.
5. A valve in a system is leaking. How would you identify it? In the field and in the flowsheet?
6. You identified a valve in a flowsheet. Its number is 4212V47. Describe how you would proceed in identifying it in the field.
7. Identify circled components in the attached sheet.

K. Mika

ADDENDUMMechanical Equipment Device Code

ACU	Air Conditioning Unit	HTR	Heater
ARV	Air Release Valve	HTE	Heater Electrical
BO	Boiler	HX	Heat Exchanger
BRG	Bearing	LU	Lubricator
CCR	Cooling Coil - Refrig.	MV	Power Operated Valve
CCW	Cooling Coil - Water	NV	Non Return Valve (Electric, Air or Hydraulic)
CD	Condenser	NZ	Nozzle
CP	Compressor	P	Pump
CR	Crane	PCV	Pressure Control Valve
CTU	Coolant Tube	PO	Pneumatic Operator
CV	Control Valve	PRV	Pressure Regulating Valve
DC	Drain Cooler	RD	Rupture Disc
DP	Damper	RV	Relief or Safety Valve
DR	Chemical Dryer	SC	Screen
DY	Dryer	SD	Steam Drum
EJ	Expansion Joint	SP	Separator
F	Fan	SF	Swaged Fitting
FC	Fluid Coupling	STR	Strainer
FCV	Flow Control Valve	SV	Solenoid Valve
FM	Fuelling Machine	SAE	Air Ejector (Steam Jet)
G	Generator	TK	Tank
SG	Standby Generator	TP	Trap
GR	Gear Reducer	TRV	Temperature Regulating Valve
HA	Hanger - Anchor	TU	Turbine
HCS	Heating Coil (Steam)	V	Valve (Manually Operated)
HCW	Heating Coil (Water)		
HR	Hanger Rigid (Pipes, etc)		
HV	Hanger Variable		

VALVE SYMBOLS

NORMALLY OPEN	NORMALLY CLOSED	PERM THROTTLED
GATE VALVE	GATE VALVE	GATE VALVE
GLOBE VALVE	GLOBE VALVE	GLOBE VALVE
BUTTERFLY VALVE	BUTTERFLY VALVE	BUTTERFLY VALVE
NEEDLE VALVE	NEEDLE VALVE	NEEDLE VALVE
BALL VALVE	BALL VALVE	BALL VALVE
DIAPHRAGM VALVE	DIAPHRAGM VALVE	DIAPHRAGM VALVE
PLUG VALVE	PLUG VALVE	PLUG VALVE
RELIEF VALVE		
ANGLE VALVE	ANGLE VALVE	ANGLE VALVE
NON RETURN VALVE (CHECK VALVE)		
COMBINED STOP & NON RETURN VALVE	COMBINED STOP & NON RETURN VALVE	
VALVE WITH EXTENDED HANDLE	VALVE WITH EXTENDED HANDLE	VALVE WITH EXTENDED HANDLE
PLUGGED VALVE		
SAFETY VALVE		
AIR HOSE QUICK CONNECT		
THREE WAY VALVE		

VALVE OPERATORS

	PISTON OPERATOR
	ELECTRIC OPERATOR
	AIR OPERATED-AIR TO OPEN MAY BE CV, MV OR PV
	AIR OPERATED-AIR TO CLOSE
	AIR OPERATED-AIR TO OPEN AIR TO CLOSE
	ELECTRO HYDRAULIC OPERATOR
	HYDRAULIC OPERATOR

HYDRAULIC OR PNEUMATIC VALVES

	TYPICAL 2 WAY VALVE
	AIR OPERATOR
	ELECTRIC OPERATOR
	PALM BUTTON OPERATOR
	CAM OPERATOR
	SPRING RETURN

EQUIPMENT & LINE SYMBOLS

	TEE
	CROSS CONNECTION
	CROSS OVER
	CAPPED BLANKED PLUGGED OR FLANGED PIPE
	REDUCTION
	ORIFICE VENTURY OR ELBOW TAPS FOR FLOW MEASUREMENT
	RUPTURE PANEL
	SPECTACLE FLANGE
	STRAINER (Y TYPE)
	STRAINER (BASKET TYPES)
	FILTER
	AUTOMATIC AIR VENT
	LAGGED AND ELECTRICALLY HEATED LINE
	SEPARATOR
	TRAP B BUCKET IB INVERTED BUCKET T THERMOSTAT FT FLOAT THERMOSTAT TD THERMODYNAMIC FLOAT
	OPEN DRAIN
	EXPANSION JOINT
	QUICK CONNECTOR
	SAMPLE STATION
	FLEXIBLE CONNECTION
	CENTRIFUGAL PUMP
	GEAR PUMP
	RECIPROCATING PUMP
	SCREW PUMP
	HEAT EXCHANGER
	EJECTOR INJECTOR OR EDUCTOR

VENTILATION

	SUPPLY LINE		FILTER
	EXHAUST LINE		CONDENSER
	FIRE DAMPER		FLAME ARRESTER
	DAMPER OPEN		DAMPER CLOSED
	POWERED DAMPER		CENTRIFUGAL FAN OR BLOWER
	SUPPLY REGISTER		AERIAL FAN OR BLOWER
	EXHAUST REGISTER		FORCED CONVECTION COOLING UNIT
	LOCAL EXHAUST		COOLING OR HEATING COIL
	EXHAUST HOOD		CONNECTED RADIATOR
	FIXED LOUVER		UNIT HEATER (WITH FAN)
	RUPTURE PANEL		ROOF VENTILATOR SUPPLY GRAVITY
	ELECTRIC HEATER		ROOF VENTILATOR EXHAUST GRAVITY
			ROOF VENTILATOR SUPPLY POWERED
			ROOF VENTILATOR EXHAUST POWERED

GAS

	COMPRESSOR		LUBRICATOR
--	------------	--	------------

GENERAL

	CROSS REFERENCE TIE POINT ON SAME FLOWSHEET
	CROSS REFERENCE TIE POINT ON INTERRELATING SEPARATE FLOWSHEETS
	CROSS REFERENCE TO ANNUNCIATION CHART

INSTRUMENTATION

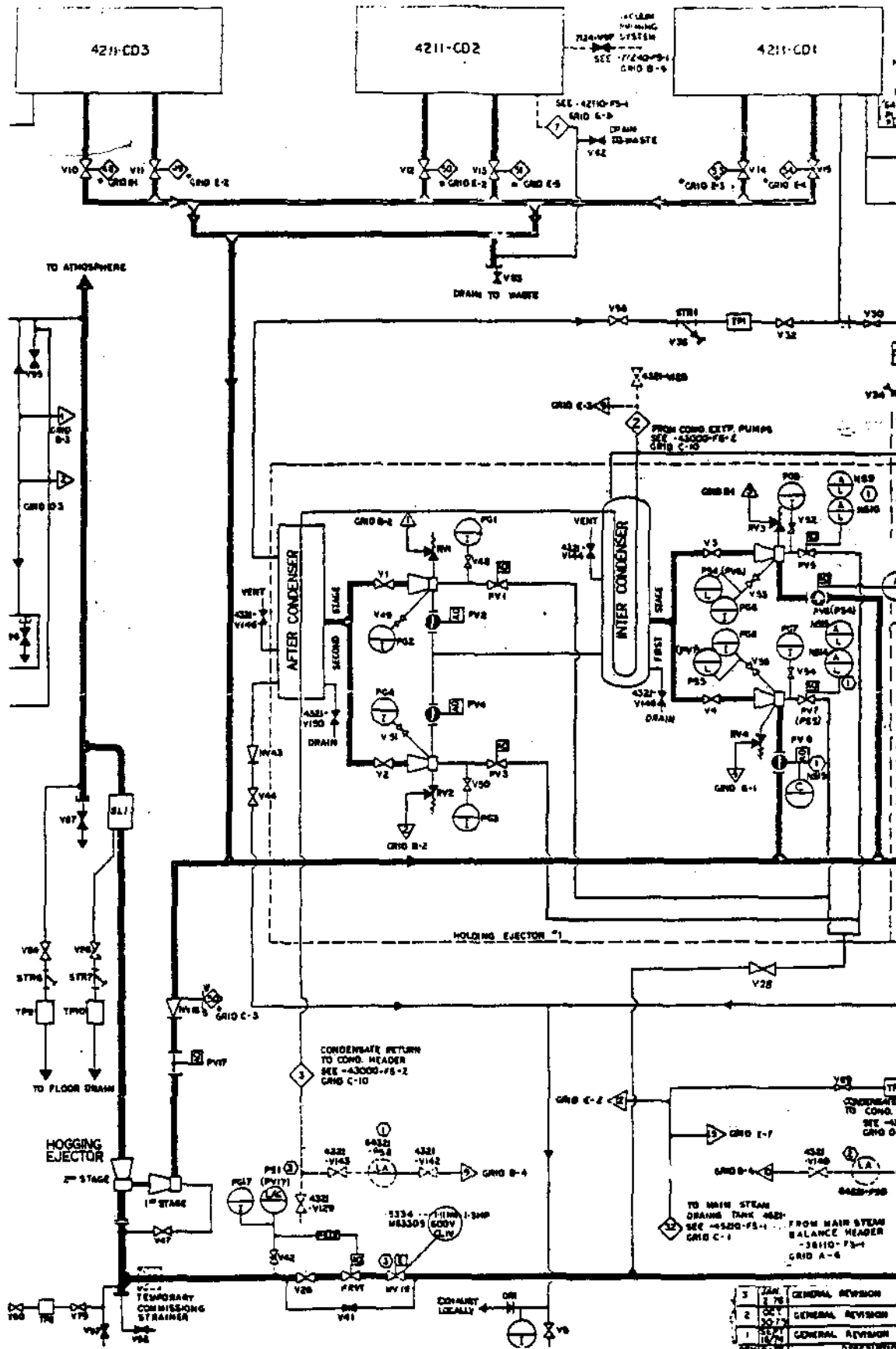
	INSTRUMENTATION DEVICE WITH INDICATION IN CONTROL ROOM
	INSTRUMENTATION DEVICE WITH INDICATION ON LOCAL PANEL
	INSTRUMENTATION DEVICE WITH INDICATION AT THE EQUIPMENT

SUBJECT INDEX — BRUCE G.S.

DIVISION 4 TURBINE GENERATOR & AUXILIARIES

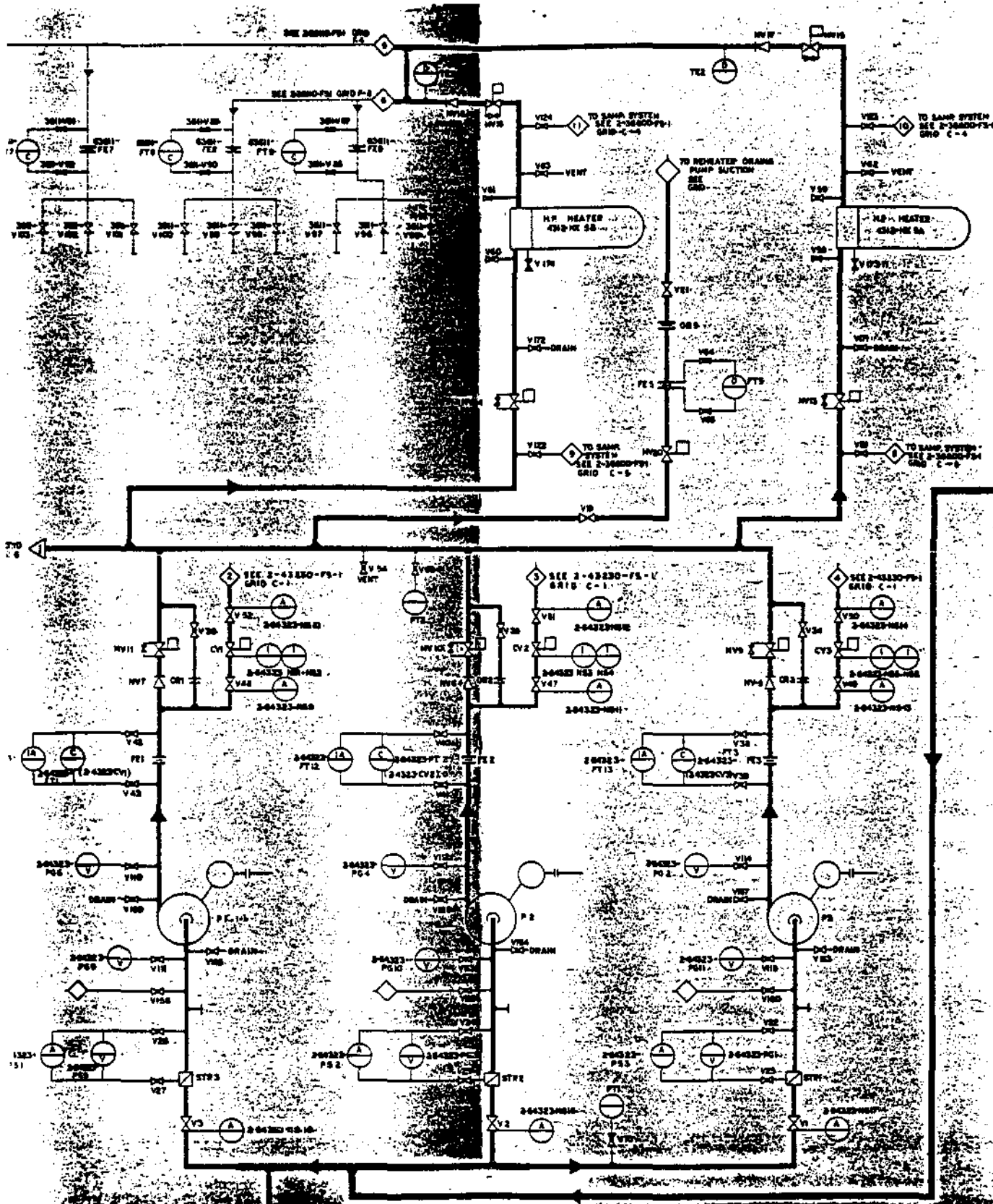
40000 TURBINE GENERATOR & AUXILIARIES	41400 Moisture Separation System	43119 Piping
40010 Performance Testing	41410 Separator	43140 Heater Vents System
41000 TURBINE GENERATOR	41420 Separator Drains System	43143 Valves
41010 Tender Evaluation	41421 Valves	43148 Pipe supports
41020 Lubricating System	41428 Pipe supports	43149 Piping
41030 Maintenance Equipment	41429 Piping	43150 Heater Relief Valve System
41031 Handling equipment	41500 Steam Reheat System	43153 Valves
41092 Tools	41510 Live Reheat Steam System	43158 Pipe supports
41100 Turbine & Auxiliary Equipment	41513 Valves	43159 Piping
41110 Turbine	41518 Pipe supports	43200 Condensate & Feedwater System
41111 Bearings	41519 Piping	43210 Condensate System
41112 H.P. casings and rotors	41520 Reheater	43212 Extraction pumps
41113 L.P. casings and rotors	41521 Tubing	43213 Valves
41120 Emergency Stop & Governor Valves	41530 Reheater Drains System	43218 Pipe supports
41130 Reheat Stop & Intercept Valves	41532 Drains pumps	43219 Piping
41140 Turning Gear	41531 Valves	43220 Condensate Make-up & Rejection System
41150 Gland Seal System	41534 Drains tank	43222 Pumps
41160 Turboregulatory Equipment	41538 Pipe supports	43223 Valves
41170 Governing System	41539 Piping	43224 Storage tank
41180 Steam Reject System	41540 Reheater Vent System	43228 Pipe supports
41181 Valves	41543 Valves	43229 Piping
41188 Pipe Supports	41548 Pipe supports	43230 Boiler Feed System
41189 Piping	41549 Piping	43232 Pumps
41190 L.P. Exhaust Cooling System	41550 Reheater Blanket System	43233 Valves
41200 Generator & Auxiliary Equipment	41560 Reheat Safety Valve System	43234 Gland seal tank
41210 Alternator	41563 Valves	43235 Strainers
41211 Bearings	41568 Pipe supports	43238 Pipe supports
41212 Hydrogen seals	41569 Piping	43239 Piping
41220 Excitation	41570 Hot Reheat	45000 AUXILIARY SYSTEMS
41221 Exciters	41573 Valves	45100 Sampling System
41222 Field cabling	41578 Pipe supports	45110 Sampling Circuit
41223 Field breakers	41579 Piping	45111 Coolers
41230 Hydrogen Cooling System	41580 Cold Reheat	45112 Pumps
41231 Heat exchangers	41583 Valves	45113 Valves
41233 Valves	41588 Pipe supports	45118 Pipe supports
41237 Purging equipment	41589 Piping	45119 Piping
41238 Pipe supports	42000 CONDENSING SYSTEMS	45200 Drain Systems
41239 Piping	42100 Main Condensing System	45210 Steam Drain System
41240 Stator Cooling System	42110 Main Condenser	45211 Traps
41241 Heat exchangers	42111 Condenser	45212 Pumps
41242 Pumps	42118 Tubing	45213 Valves
41243 Valves	42120 Condenser Air Extraction System	45214 Tanks
41244 Stator water tank	42121 Ejectors	45218 Pipe supports
41248 Pipe supports	42122 Vacuum pumps	45219 Piping
41249 Piping	42123 Valves	45220 Drain & Waste System
41250 Seal Oil System	42128 Pipe supports	45223 Valves
41251 Heat exchangers	42129 Piping	45228 Pipe supports
41252 Pumps	43000 FEEDWATER SYSTEMS	45229 Piping
41253 Valves	43100 Feedwater Heating Systems	45230 Air Vents
41258 Pipe supports	43110 Extraction Steam System	45233 Valves
41259 Piping	43113 Valves	45238 Pipe supports
	43118 Pipe supports	45239 Piping
	43119 Piping	45300 Gland Injection System
	43120 Feedwater Heaters	45310 Pump Gland Injection System
	43121 Closed heaters	45311 Coolers
	43123 Deaerator	45312 Pumps
	43123 Valves	45313 Valves
	43130 Heater Drains System	45314 Tanks
	43132 Drain pumps	45318 Pipe supports
	43133 Valves	45319 Piping
	43138 Pipe supports	

430.10-0



3	JAN 8 76	GENERAL REVISION	DUP 1/2
2	OCT 30 75	GENERAL REVISION	DUP 1/2
1	SEP 16 74	GENERAL REVISION	DUP 1/2
		REVISOR	DESCRIPTION

BRUCE G.S.A. - UNIT 2
 OPERATIONAL FLOWSHEET
 CONDENSER AIR EXTRACTION SYSTEM



BRUCE, G. S.
 OPERATIONAL FLOW SHEET
 H.P. FEEDWATER
 SYSTEM
 MADE BY: []
 H. ALDRUP [] R. J. SHAW []
 NK21-OP-2-43230-F5-3-R-0