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APPENDIX-11 INSTRUMENT PIPING STANDARDS

DESIGN STANDARDS FOR INSTRUMENT PIPING

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I. INSTRUMENT PIPING

I - 1. Specifications

(1) Selection standards on piping materials

applicable design pressure for selection of an instrument piping should be same pressure as main piping.

Applicable design temperature for selection of an instrument piping should be same as main piping up to instrument valve (up to reservoir when reservoir is needed)., and applicable design temperature for downstream of the root valve should be saturated temperature equivalent to main piping pressure.

(a) Classification by temperature

Temperature °F (°C)	-662 -(350)	663-752 (351-400)	753-932 (401-500)	933-1112 (501-600)
Piping Materials	STPG38	STPT38	STPA12 or STPA22	STPA22 or STPA24

Note: Copper should be applied to sea water instrument pipings.

(b) Nominal diameter

2B(50A): Balancing Pipe, instrument for level transmitter mounted on a tank or vessel.

1B(25A): Instrument piping up to instrument root valve for pressure or flow transmitter on high pressure line, and boiler drum level transmitter.

3/4B(20A) : Instrument piping for water level gauge or transmitter.

1/2B(15A) : Instrument piping for pressure or flow meter.

(C) Pipe Thickness

In principle, pipe thickness should be in accordance with SGP schedule No. 40, 60, 80.

(2) Selection standards for valves, connectors materials

Applicable design pressure for valves, connectors are same as I-1 (1).

(a) Classification by temperature

Temperature °F (°C)	(-400)	(401-500)	(501-600)
Valves, connectors materials	S25C, S28Cor SF45	A182-F11 orA182-F12	A182-F12 or A182-F22

Note: Bronze castings should be applied to sea water, air and cooling water pipings.

(b) Nominal diameter

Same as I-1 (1)-(a)

(c) Pipe thickness

Same as I-1 (1)-(b)

(d) Valve Type

Ball valve with handle should be in principle applied to.

(3) Size of tapping line for pressure and flow detecting devices should be, in principle, classified into two types by the pressure applied to.

1B (25A) : More than 50 Kg/cm^2

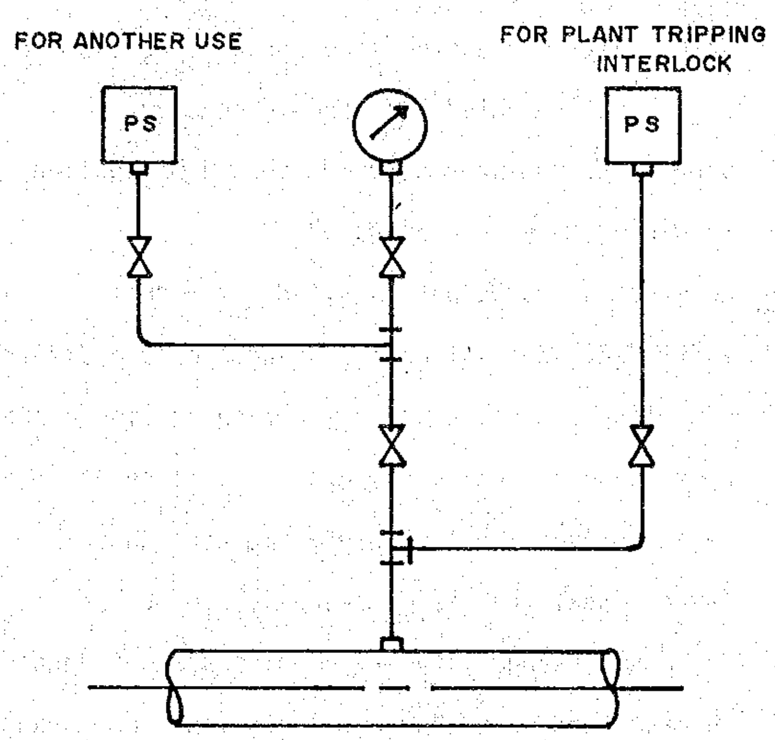
1/2B (15A): Less than 50 Kg/cm^2

Note: Size of tapping line for cold reheat and not reheated line should be 25A.

(4) Double instrument root valve should be applied to piping more than 50Kg/cm^2.

(5) Reservoirs should be installed after the instrument root valves for steam pressure difference detecting device, however, in case of liquid pressure difference detecting devices, or in case of force balance type high pressure difference detecting devices that the performance will not be affected by volume changes, the reservoirs are not needed.

(6) In case that more than one instruments are branched from one pipe, most important instrument used for plant tripping interlock and auxiliary tripping interlock should branched before the instrument root valve, but that for another use should be branched after the instrument root valve.


FOR ANOTHER USE
FOR PLANT TRIPPING
INTERLOCK
PS
PS

(7) Test plug (PT-1/4B) should be in principle installed in the instrument pipings for pressure transmitter, controller and switch for the purposes of tests and replacement of scaling liquid, etc.

(8) Drain blow valve should not be installed in oil piping for the purpose of diminishing the leaky portions as possible.

For the vacuim detecting line, the instrument should be installed in a higher location than detecting point for non-clogging of drain, and drain blow valve should not be installed in the line to avoid leakage.

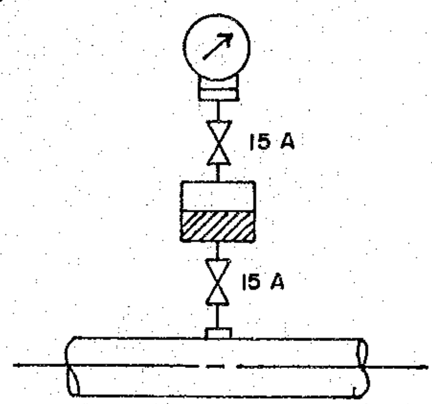
(9) Instrument piping should be installed taking the thermal expansion and the movement due to heat into consideration.

(10) Instrument piping should be supported by adequate supporter.

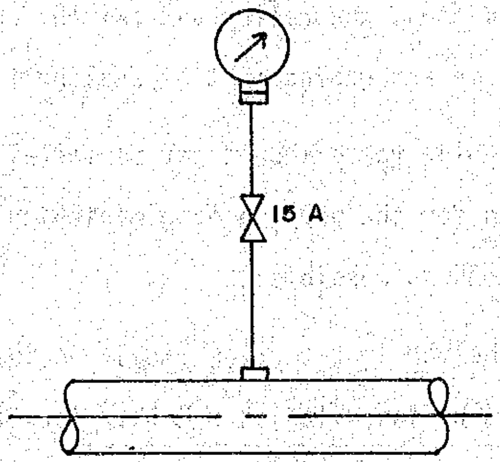
I - 2 INSTALLATION

(1) Local pressure gauge and test tap

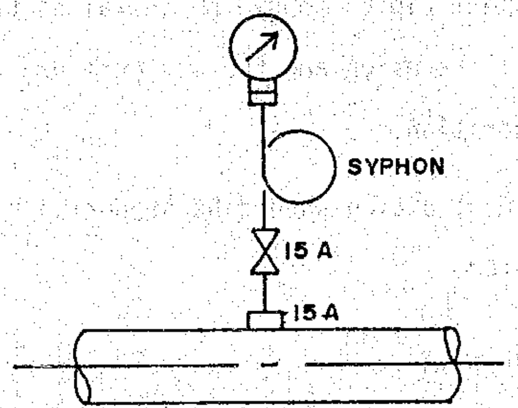
(a) Fuel Oil Line



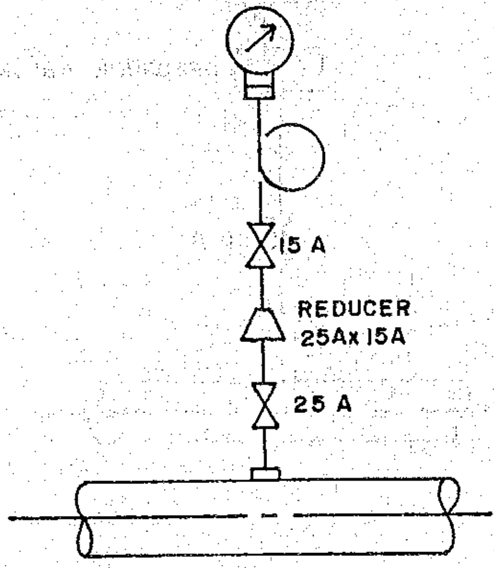
(b) Air line less than 50 kg/cm^2 or water line less than 100^{o}C.



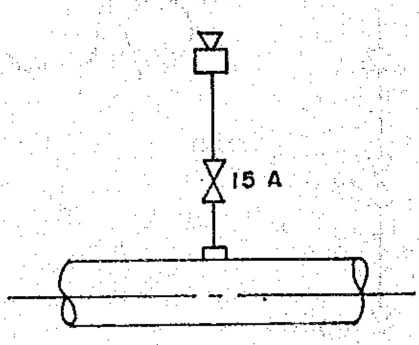
(c) Steam, water line less than 50 kg/cm^2 and mone.than 100^{o}C.



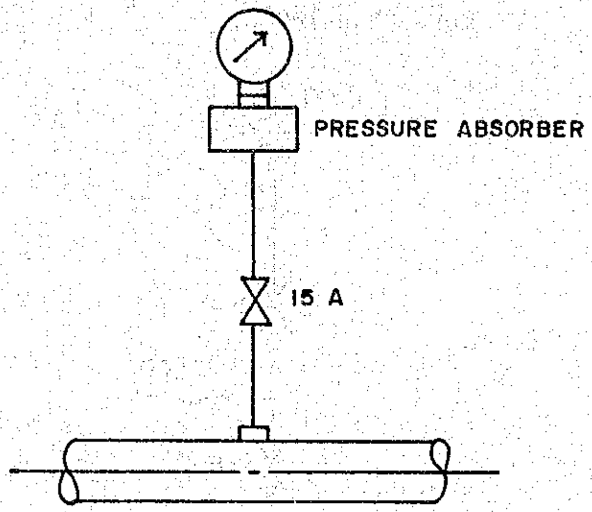
(d) Steam water line more than 50 kg/cm^2 and more than 100^oC.



(e) Test Tap.

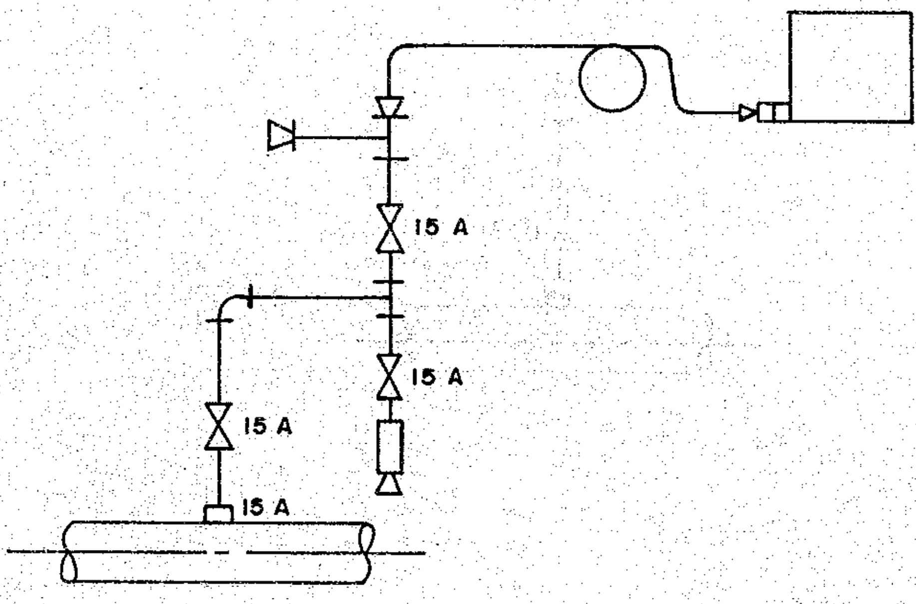


(f) Installation of pressure absorber.

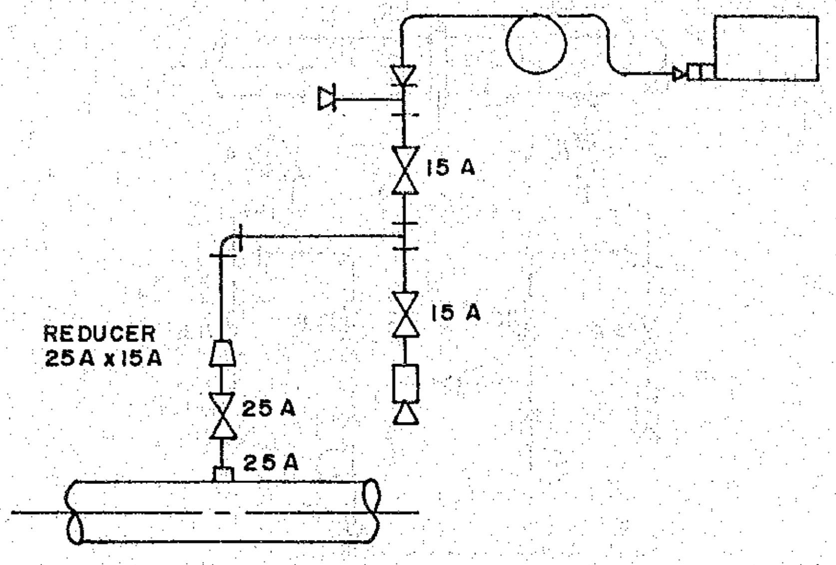


(g) Pressure transmitter, controller and switch

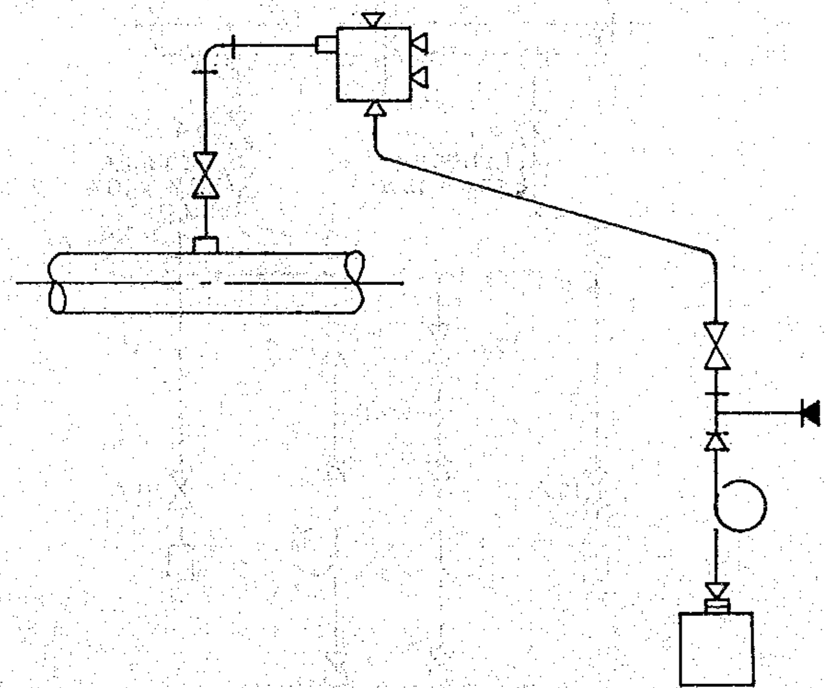
(a) Less than the pressure of 50 Kg/cm^2



(b) More than the pressure of 50 Kg/cm^2.

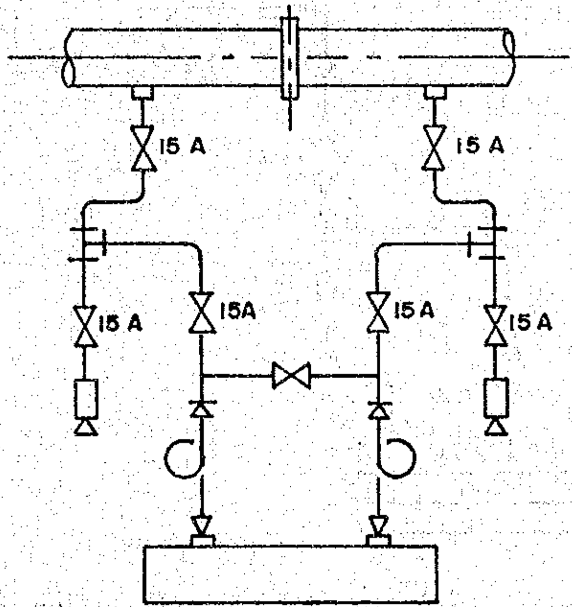


(c) In case of installation of oil separating chamber.

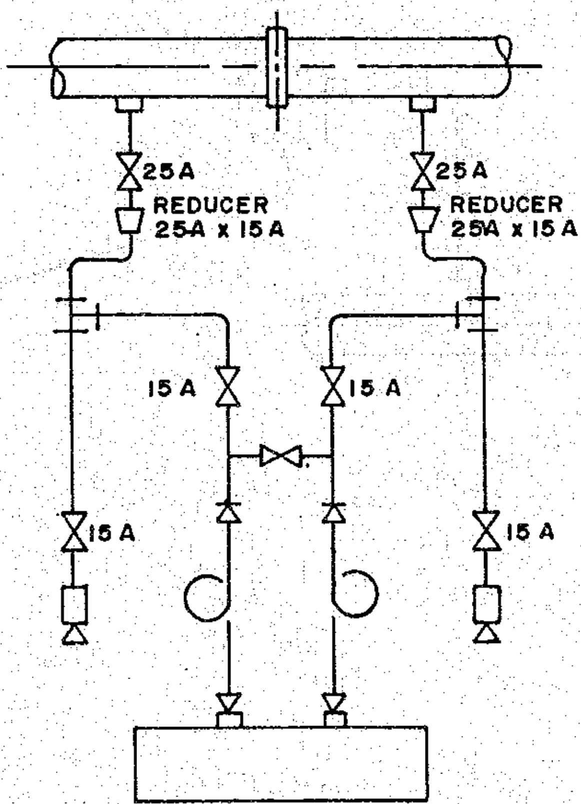


(3) Differential pressure transmitter

(a) Less than the pressure of 50 Kg/cm^2

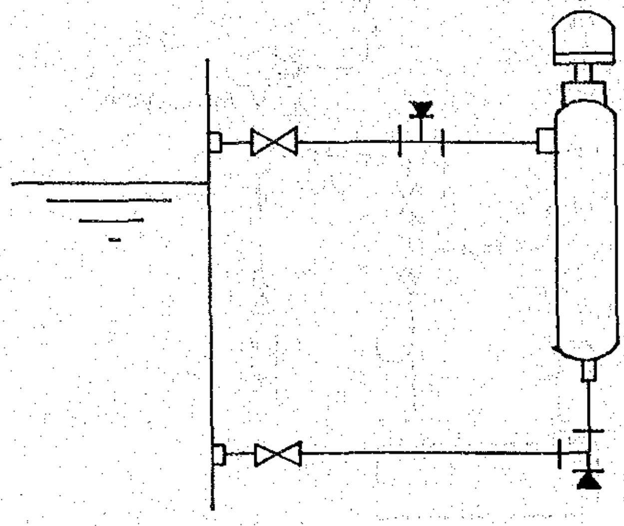


(b) More than the pressure of 50 Kg/cm^2

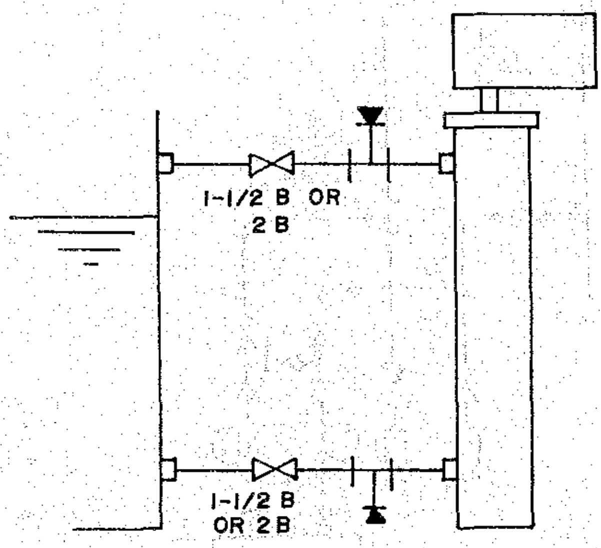


(5) Displacement type level transmitter, controller and switch.

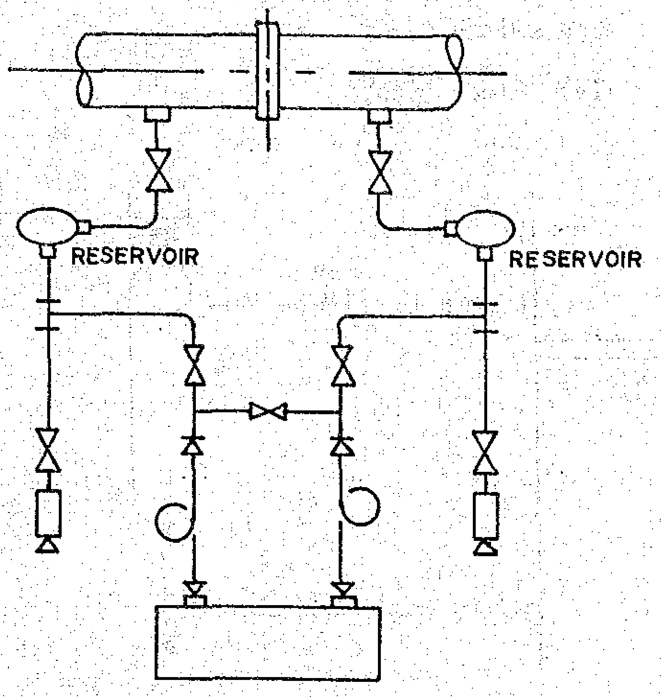
(a) Float type



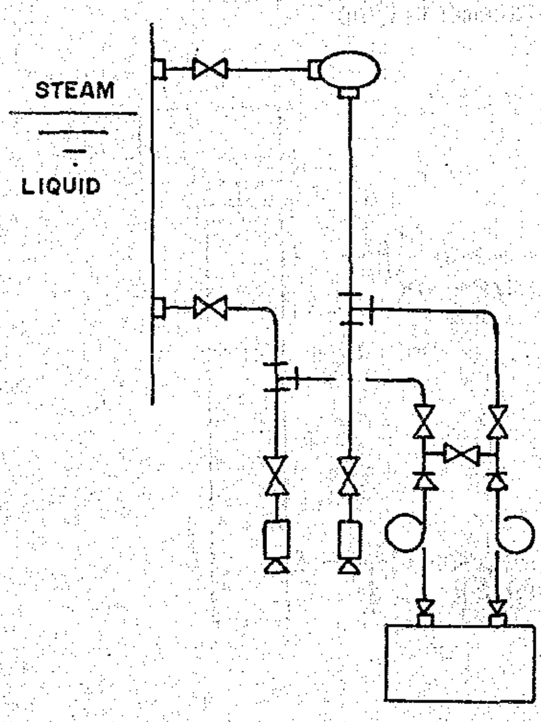
(b) Displacement type



(c) In case of installation of reservoir (for steam)



(4) Differential pressure type level transmitter



II. SUPPLY AND SIGNAL AIR PIPING

II - 1 Specifications

(1) Selection of piping materials

Piping	Materials	Size	Remarks
Supply Air			
a) Up to interface point	SGP-W	1/2B, 1B, 1-1/2B, 2B	JIS G-3452
b) From interface point to control cabinet	Copper pipe PJC-DCut	6/4 Ø 8/6 Ø 10/8 Ø	JIS H-3603
c) Inside Cabinet	Copper Pipe	6/4 Ø 10/8	JIS H-3603
SIGNAL AIR			
Output Signal	Copper pipe	6/4 Ø 8/6 Ø 10/8 Ø	JIS H-3603 JIS C-3401

(2) Selection of attachment materials

	Name	Type	Materials	Remarks
SGP-W	Connector		SGP, FCBM or BSBF	Taper Screw
	VALVE		BC	Taper Screw
Copper Pine	Connector	Flare	BSBM	
Copper Pipe				
Cable	Valve	Flare	BSBM	Miniature valve
Cabinet or unctional box inside	Terminal block,supply header	Flare	BSBM	
	valve	flare	BSBM	Miniature valve

(3) Instrument air to controller, transmitter and controller air should be supplied from supply air header installed in the junction box

(4) Copper pipe cable should be in principle arranged in the cable tray or cable duct same method as electrical cabling.

II - 2. INSTALLATION

(1) Branch pipe on the supply air header pipe should be installed upward.

(2) All air supply pipe materials should be SGP-W and all connections should be of screw-connection type.

and telflon seal tape and seal bondage should be used at every connecting portion.

(3) Controller and instrument should be connected to instrument air pipe through the bare copper pipe for the purpose of flexibility.

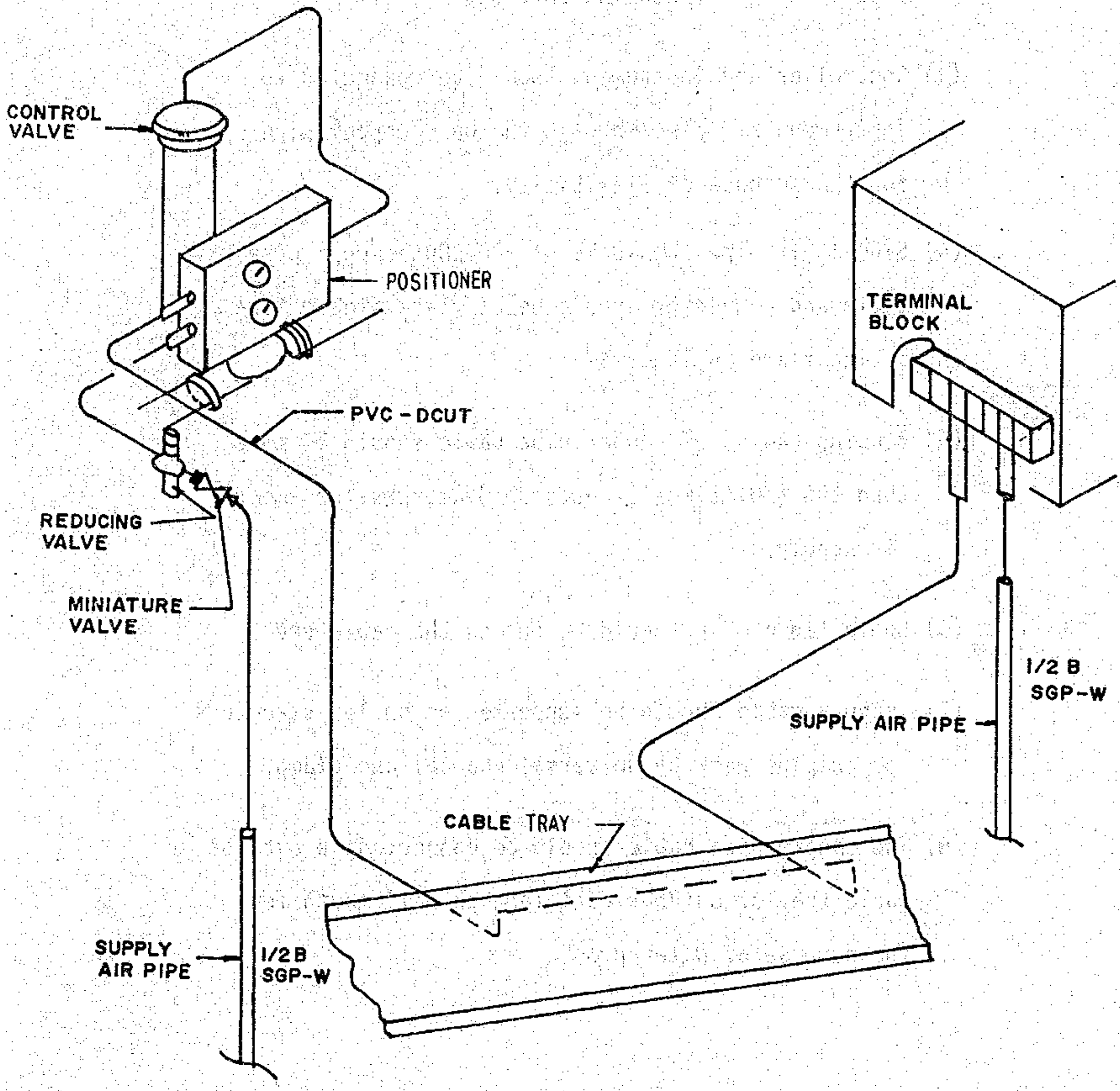
(4) Signal air pipe should be of PJC-DCut copper pipe cable and connector should be of flare sleeve type having flare angle of 37°.

(5) Bending radius of copper pipe cable should be more than ten (10) times of outside diameters for smooth air supply.

(6) Cable tag number should be put on the cable end.

(7) Copper cable should be supported on boiler structure or on pipe rack by universal channel and clamp.

(8) The copper pipe cable should be connected to outdoor cable tray or outdoor duct through bell-mouth for the purpose of water-proof.


CONTROL VALVE
POSITIONER
TERMINAL BLOCK
PVC - DCUT
REDUCING VALVE
MINIATURE VALVE
1/2 B SGP-W
SUPPLY AIR PIPE
CABLE TRAY
SUPPLY AIR PIPE
1/2 B SGP-W

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APPENDIX-12 DESIGN CONCEPT FOR HEATER

DESIGN CONCEPT FOR FEED WATER HEATER

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II. HEATING STEAM VELOCITY	1
III. FLOW VELOCITY INSIDE THE BLED STEAM PIPING	1
IV. FLOW VELOCITY INSIDE THE HEATER DRAIN PIPING	1
V. INLET/OUTLET FEED WATER VELOCITY	1
VI. HEATER DRAIN INLET VELOCITY	2
VII. HEATING STEAM (BLED STEAM), HEATER INLET FLANGE VELOCITY	3
VIII. HEATER DRAIN, HEATER OUTLET, OUTLET FLANGE VELOCITY	3
IX. NITROGEN (N_2) SEALING	3
X. RELIEF VALVE CAPACITY	3
XI. VENT CAPACITY	4

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DESIGN CONCEPT FOR FEED WATER HEATER

This concept is presented only as an example. With regards to detailed specifications, please discussed with manufacturer.

I. Fluid Velocity in Tube

Design Point

Usually approximately 2 m/s ± 0.2 m/s
In case of one-sided operation, the fluid velocity will be allowed up to approximately 3 m/s at approximately 75% load of MCR.

II. Heating Steam Velocity
The limitation will be around 180% flow rate of design point to prevent tube vibration and erosion.

III. Flow Velocity Inside the Bled Steam Piping

Maximum allowable velocity will be up to approximately 80 to 90 m/s, however, it depends on pressure loss in the piping.

IV. Flow Velocity Inside the Heater Drain Piping

Maximum allowable velocity will be up to approximately 1.5 to 2.0 m/s.

V. Inlet/Outlet Feed Water Velocity

Maximum allowable velocity will be up to approximately 3.0 m/s.

VI. Heater drain inlet velocity

1. Two-phase flow (water/steam): $G^2 mass/r \leqq 6000$
2. Flush steam : $G^2 mass/r \leqq 1500$
3. Water (P = 1) : Max. velocity ≑ 1.2 m/s

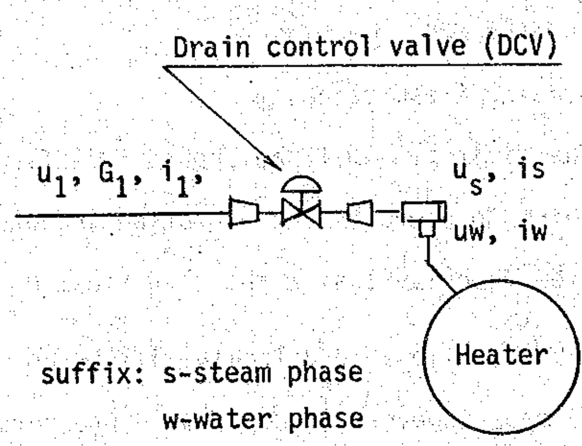
G mass: Flow rate/area second ($kg/m^2/s$)

r : Specific weight (kg/m^3)

G : Total heater drain flow rate (kg/h)

i : Specific enthalphy (kcal/kg)

u : Specific volume (m^3/kg)



From the heater balance around DCV, the following formula can be attained.

$$G1 \cdot i1 = Gw \cdot iw + Gs \cdot is$$

$$G1 = Gs + Gw$$

$$G1.i1 = (G1-Gs).iw + Gs.is \qquad G1.i1 = Gw.iw + (G1-Gw).is$$

$$Gs = \frac{G1(i1-iw)}{is - iw} \qquad Gw = \frac{G1(is-i1)}{is - iw}$$

$$Gw = G1 - Gs \qquad Gs = G1 - Gw$$

$$r = \frac{Gs + Gw}{Gs.us + Gw.\ uw}$$

$$\text{Velocity} = \frac{Gw.Uw + Gs.Us}{\text{Area}}$$

$$\text{G mass} = \frac{G1}{3600 \times \text{Area}} \quad \text{kg/m2/s}$$

For heater drain piping after $DC\bar{V}$;

- in case of $Gmass/r \leq 6000$, carbon steel pipe will be applicable
- in case of $G\ mass/\ r > 6000$, alloy steel pipe schedule 80 will be necessary.

VII. Heating Steam (Bled steam), Heater Inlet Flange Velocity

Maximum allowable velocity will be up to approximately 45 m/s

VIII. Heater drain, Heater Outlet Flange Velocity

- in case that heater drain level is maintained normally: Max. 1.2 m/s
- in case that heater drain level is not maintained normally : Max. 0.6 m/s

IX. Nitrogen (N_2) Sealing

In case of application of N_2 seal, the necessary volume of N_2 gas will be approximately 1.4 times of heater volume

X. Relief Valve Capacity

1. Shell Side: 10% of feed water flow rate under rated output (10% tube leakage is considered.)

2. Water Box Side:
   - Feedwater flow rate more than 150 t/h: size 20A
   - Feedwater flow rate less than 150 t/h: size 15A

XI. Vent Capacity

1. Approx. 1/200 (t/h) of heating steam flow rate under rating output.
2. For deaerator, 1/100 (t/h) of heating steam flow rate under rating output. (In case of tray type deaerator --- since the tray type deaerator has condensing function by direct contact of steam-cool water in the tray system up to vent pipe.)

APPENDIX-13 GENERAL ASSESSMENT OF ON-GOING G-2 ANNUAL OVERHAUL

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GENERAL ASSESSMENT ON G - 2 OVERHAUL

QAG-82-0160
August 17, 1982

Mr. V. G. Villanueva
Manager
Sukat Thermal Plant

SUBJECT: General Assessment on G-2 Overhaul

Transmitted herewith is a copy of the JICA Mission report on the above subject for your information and reference.

It is therefore requested that items in the report which could possibly be implemented be given preferential attention prior to the forthcoming Unit-start-up.

L. E. OSILLA
Manager
Quality Assurance Group
Office of the President

Atta. : a/s

cc.: Mr. T. H. Calasanz
Mr. M. Mano
Mr. A. Estandian
Mr. T. Oga
Mr. N. Pedron
Mr. S. Aberin
QA File

August 13, 1982

MEMORANDUM -

FOR : Mr. L. F. Osilla
Manager
Quality Assurance Group

FROM : JICA Group Members
Gardner/Snyder Thermal Plants

SUBJECT : General Assessment of Ongoing
G-2 Annual Overhaul

In compliance with your request and as confirmed by Mr. T. Oga, JICA Group members assigned at Gardner/ Snyder Thermal Plant, together with NPC counterparts conducted a thorough ocular inspection of Gardner Unit No. 2 for two days, (August 12-13, 1982 inclusive) in order to have a general assessment on the ongoing annual overhauling of the Unit.

Attached herewith are our general findings for your information and endorsement to appropriate level of plant management for possible implementation. Further, we would like to emphasize that with the Unit overhaul already nearing completion based on schedule, there are still several valves in almost all plant systems which were not inspected, repaired and/or repacked, and if not attended to may possibly affect operation of the Unit

Should you need some further clarification on the attached report please feel free to contact us.

K. Ariyoshi

K. ARIYOSHI
Mechanical Engineer
WEST JEC

JICA - NPC COUNTERPART INSPECTION REPORT
ON G-2 OVERHAUL CONDUCTED AUGUST 12 - 13, 1982

1.0 COMMON ITEMS TO ALL FACILITIES

1.1 Replacement of valve gland packings.

Gland packings of the following valves should all be replaced without fail prior to unit start-up.

1.1.1 Root valves for instrument

1.1.2 Root valves for sampling (Refer to Sheet-A)

1.1.3 Control valves (Refer to item 4.2)

1.1.4 Air vent valves and drain valves on high pressure, temperature piping

1.1.5 Valves on vacuum line

1.1.6 Root valves for level indicator (HP, LP heater; Deaerator, etc.)

1.1.7 Other defective valves

1.1.8 Retightening of gland packings after start-up

1.1.9 Provide identification on piping, and/or name plate of valves including instruments to avoid misoperation.

1.1.10 Complete heat insulation of pipings and equipments requiring insulation.

1.1.11 Repair or installation of additional sump pumps to avoid flooding of areas and for protection of equipments.

1.2 Inspection and repair of all control valves and/or replace if necessary, to ensure smooth operation of plant systems.

2.0 BOILER AND RELATED FACILITIES

2.1 Inspection and repair of fuel oil strainers. Provide also spare strainers.