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CLIENT: **TAKEDA**	
PROJECT **BURITI EPCMV PROJECT**	

PLANT STEAM/CONDENSATE DESCRIPTION REPORT

1	25MAY2022	ISSUED FOR CONSTRUCTION AS PER N+1 UPDATE	PTC	MPA	MSS
0	30JUL2021	ISSUED FOR CONSTRUCTION	MPA	LFF	MSS
A	01JUL2021	90% DD ISSUE	MPA	CCO	MSS
RE	DATE	DESCRIPTION	EXEC	CHECK	APPROV

1. REVISION HISTORY

Rev	Reason For Change
A	90% DD ISSUE
0	FLOWRATES HAVE BEEN UPDATED AS WELL AS THE PRESSURE REDUCTION VALVES. ALL DATA WERE UPDATED ACCORDING TO IPS INFORMATION.
1	AS PER N+1 UPDATE

2. PURPOSE

This document aims to describe the process characteristics for the Plant Steam Distribution System and Condensate Collecting System for Buildings 7A (Final Drug Product – FDP) and 7B (Bulk Drug Substance – BDS), intended to Takeda unit - Buriti Project, located at Hemobrás site in Goiana – Pernambuco state, Brazil.

3. REFERENCE

The following documents were used as reference:

Item	Number	Title
01	PRD-MEC-CLC-001	PLANT STEAM / CONDENSATE – CALCULATION REPORT
02	7C-M-0-5-61	P&I DIAGRAM BOILER'S BUILDING – PLANT STEAM GENERATION SYSTEM
03	7A-M-0-5-61	P&I DIAGRAM DRUG PRODUCT– PLANT STEAM DISTRIBUTION SYSTEM (PROCESS + HVAC)
04	7A-M-0-5-62	P&I DIAGRAM DRUG PRODUCT – CONDENSATE COLLECTING SYSTEM (PROCESS + HVAC)
05	7B-M-0-5-61	P&I DIAGRAM DRUG SUBSTANCE– PLANT STEAM DISTRIBUTION SYSTEM (PROCESS + HVAC)
06	7B-M-0-5-62	P&I DIAGRAM DRUG SUBSTANCE – CONDENSATE COLLECTING SYSTEM (PROCESS + HVAC)
07	7C-M-0-5-41	P&I DIAGRAM BOILER'S BUILDING – SOFTENED WATER SKID FOR BOILERS

4. PROCESS DESCRIPTION

The entire plant steam generation system located in the Boiler's House in building 7C will be provided by the vendor in a package, consisting of two steam boilers B-7C-2/3 (two operating) with a 4,200 kg/h capacity each boiler, thus operating with a maximum capacity of 8,400 kg/h.

The Steam Generation System was sized to feed the process and HVAC´s equipment for buildings 7A and 7B based on the following conditions:

- DESIGN CONDITION – Sizing criteria for equipment performed by IPS (7,094.1 kg/h) and an oversizing of 1,305.9 kg/h where the excess of flow rate is diverted to a future expansion (tie-in), totalizing the maximum flow rate of the boilers (8,400 kg/h).

- MAXIMUM OPERATING CONDITION – Sizing criteria for equipment performed by IPS (7,094.1 kg/h).

The fuel source will be natural gas with an available operating pressure of 1.0 barg at Battery limit of the Building 7C.

The make-up water will be fed with industrial water @ 3 barg to a softener (WS-6000-01/02) with a capacity of 10 m³/h. The industrial water has a feed flow rate of 12 m³/h because it was considered a 20% clearance according to the vendor information. The need of a booster pump (P-WS-7C-1) to pump the industrial water to the softener as well as the need of a pressure reducing valve shall be evaluated by the vendor.

The softened water will be directed to the deaerator DA-7C-1 with a capacity of 10 m³/h, which will also receive a condensate contribution from the condensate collection network.

In the deaerator, the system will receive addition of chemical products through two dosing pumps (P-B-7C-4/5) to avoid problems of corrosion and scale in the boilers.

Subsequently, the condensate will pass through the P-B-7C-2/3 centrifugal pumps with a flow rate of 12.1 m³/h and 152 mlc. The condensate will be pumped to the boilers B-7C-2/3 for the steam production for the buildings 7A and 7B distribution.

The boiler and the deaerator blowdown will be directed to the BDT-7C-1 blowdown tank. In this tank, with a 1,000L capacity, the purge will be sent to industrial effluent.

The minimum equipment required for the steam generation system, but not limited to these, are listed below:

Plant Steam Generation		
P&I	**Tag**	**Equipment**
7C-M-0-5-41	WS-6000-01/02	Softener
7C-M-0-5-41	TQ-6000-01	Brine Tank
7C-M-0-5-41	P-WS-7C-1	Booster Pump (the need must be evaluated by the supplier)
7C-M-0-5-61	B-7C-2/3	Boiler
7C-M-0-5-61	P-B-7C-2/3	Centrifugal Pump
7C-M-0-5-61	DA-7C-1	Deaerator
7C-M-0-5-61	BDT-7C-1	Blowdown Tank
7C-M-0-5-61	P-B-7C-4/5	Dosing Pump

The industrial steam generated by the boilers will be distributed from building 7C. A header routes the steam to building 7A and on building 7A, another header distributes plant steam to building 7B consumers.

The Plant Steam Distribution System is separated in 3 headers for each building: one header is for equipment that operate with plant steam at least 8 bar(g), the other header is for equipment that operate with plant steam at about 4 bar(g) and the last one is for equipment that operate with plant steam at least 2 bar(g). The same occurs in the condensate.

For the flow rate and operating pressure of each equipment, see document PRD-MEC-CLC-001 – Plant Steam / Condensate – Calculation Report.

At the beginning of each header there will be a flow meter for monitoring/recording consumption, a pressure transmitter to indicate the pressure at the entrance of the header and a temperature transmitter to indicate the temperature entering the building.

Six pressure reduction stations are located in the system, three will be located in building 7A designed to reduce the steam pressure to meet the equipment with required operating pressures of about 4 bar(g) (medium pressure) and 2 bar(g) (low pressure). As the output pressure of the boilers was set at 9 bar(g), building 7B needs two pressure reducing stations to meet the equipment with required operating pressures of about 4 bar(g) and 2 bar(g). In both buildings, equipment operating at 8 bar(g) does not need pressure reduction. At these pressure reducing stations, the upstream and downstream pressure will be monitored by pressure transmitters.

All condensate generated (two phase) for each building will be segregated in three different collecting systems (one provided from the high pressure steam at least 8 bar(g), the other provided from the medium pressure steam at about 4 bar(g) and the last one provided from the low pressure steam at 2.0 bar(g)) and it goes to condensate mechanical pump, located at the Utilities Room.

The mechanical pump is supplied in a skid, with the following components:

- 1 receiver to collect the condensate two phase and to separate the exhaust steam from the condensate. It is installed above the pumps. The exhaust steam is vented to safe place;
- 2 mechanical pumps (one operating and the other as stand-by), operated with high pressure steam.

The flashed steam is vented in the pump and only the condensate is pumped to the deaerator (DA-7C-1).

These pumps have the following characteristics:

- PC-7A-1 – Building 7A

  Capacity = 2,931.0 kg/h

  Driving Fluid = High Pressure Steam – 18 kg/h @ 8.4 bar(g)

- PC-7B-1 – Building 7B

  Capacity = 4,163.1 kg/h

  Driving Fluid = High Pressure Steam – 25 kg/h @ 8.4 bar(g)

The discharge from each pump will be directed to the deaerator. Lines 1.1/2"-PC-940002-CS1-HC from Building 7A and 1"-PC-940001-CS1-HC from Building 7B.

The Bioreactors Jacket Loops BRE-5401-JL, BRE-5501-JL, BRE-5601-JL, BRE-5602-JL and BRE-5603-JL skids have their own condensate pumps, and these lines are interconnected in a single line for the deaerator (1"-PC-940013-CS1-HC).

The deaerator (DA-7C-1) works with a pressure of 0.3 bar(g). This equipment receives pumped condensate and softened water make-up. It is installed on the slab to guarantee liquid column to feed the condensate pumps P-B-7C-2/3. The level of this equipment is controlled by the level transmitter LIT-780024, by opening the softened water make-up control valve LV-780024 (low level) or by opening the drain valve LV-780001 to Blowdown Tank when the level is high.

The condensate is pumped to the boilers using the pumps P-B-7C-2 and P-B-7C-3, where the pumps work at the same time (maximum capacity).

The pumps have the following characteristics:

Flow rate = 12.1 m^3/h

Head = 152 mlc

The capacity of these pumps should be confirmed by the supplier.

All system will be controlled by Main Control Panel, according to the steam demand.

4.1 SOFTENED WATER SYSTEM

The Softener Water System for Boilers (WS-6000-01/02) is a vendor package and it is located in the Boiler's Building (7C).

The industrial water @ 3 barg is pumped by the booster pump (P-WS-7C-1) (if needed - by vendor) for the softeners WS-6000-01/02.

If needed the pump, it will be supplied with frequency inverter, but they work with a constant flow rate (200 LPM = 12m³/h).

The system has the following instruments:

Equipment	Instrument	Function
P-WS-7C-1	SC-600001	Speed Control
WS-6000-01/02	PI-600001	Local Pressure Indication
	PSHL-600001	High Pressure -shut down the pump
		Low Pressure – stop the regeneration process
		High Pressure Alarm
		Low Pressure Alarm
	AIT-600001	High Hardness – start the regeneration process
		Low Hardness – stop the regeneration process
	FIT-600002	Flow Rate Indication
	FSL-600002	Low Flow Rate Alarm
TK-6000-01	FIT-600001	Flow Rate Indication

A safety and relief valve (PSV-600001) is installed after the PSHL-600001 with a pressure set point of 5 barg.

4.2 PLANT STEAM GENERATION SYSTEM

The Plant Steam Generation System is located in the Boiler's Building (7C).

4.2.1 DEAERATOR

The deaerator has the following instruments:

Equipment	Instrument	Function
DA-7C-1	LIT-780024	Level Indication – control the level in deaerator by softened water make-up control valve (LV-780024)
	LSHH-780001	High High Level – open the Automatic on-off valve (LV-780001)
	LSLL-780001	Low Low Level – shut down the pumps P-B-7C-1/2/3
	TIT-780001	Temperature Indication

Equipment	Instrument	Function
	TI-780002	Local Temperature Indication
	LG-780001	Local Level Indication
	PI-780008	Local Pressure Indication
	PIT-780001	Pressure Indication / Control – control the pressure in 0.3 bar(g) by opening the perssure control valve (PV-780001)

To protect the deaerator against overpressure there is a Safety and Relief Valve (PSV-780021) and to protect it against the vacuum, there is a Vacuum Relief Valve (PSV-780022). These valves will be sized and supplied by the vendor package.

The control valves LV-780024 and LV-780001 will be sized and supplied by the vendor package.

4.2.2 PUMPS

The Plant Steam Generation System has the following pumps:

- P-B-7C-2/3 – centrifugal pumps to feed the boilers B-7C-1/2/3
- P-B-7C-4/5 – chemical dosing pumps

The pumps have the following instruments:

Equipment	Instrument	Function
P-B-7C-2	PI-780034	Suction Pressure Indication
	PI-780037	Discharge Pressure Indication
P-B-7C-3	PI-780035	Suction Pressure Indication
	PI-780038	Discharge Pressure Indication
P-B-7C-4	LSL-780031	Low Level – shut down the pump P-B-7C-4
P-B-7C-5	LSL-780032	Low Level – shut down the pump P-B-7C-5

4.2.3 BLOWDOWN TANK

The Blowdown Tank has the following instruments:

Equipment	Instrument	Function
BDT-7C-1	TSL-780041	Low Temperature – close the solenoid valve (TV- 780041)
	TSH-780041	High Temperature – open the solenoid valve (TV- 780041)

Interlock – Temperature to be kept in 45ºC, adding Industrial Water to cool the condensate.

4.2.4 NATURAL GAS DISTRIBUTION SYSTEM

The Natural Gas Distribution System has the battery limit at Building C, with a required pressure of 1,0 bar(g) and a maximum flow rate of 580 Nm³/h, through three lines, one for each boiler with the following instruments:

LINE	INSTRUMENT	FUNCTION
NG-780003-CS1-NI	PI-780003	Local Pressure Indication
	PCV-780003	Pressure Control Valve (1st stage)
	PCV-780006	Pressure Control Valve (2nd stage)
	PI-780006	Local Pressure Indication
	FIT-780006	Flow Rate Indication
NG-780004-CS1-NI	PI-780004	Local Pressure Indication
	PCV-780004	Pressure Control Valve (1st stage)
	PCV-780007	Pressure Control Valve (2nd stage)
	PI-780007	Local Pressure Indication
	FIT-780007	Flow Rate Indication

All instruments and control valves shall be sized and supplied by the vendor.

4.2.5 BOILERS

The Boilers shall be supplied with a Main Control Panel and they shall be controlled by the PIT/PIC-780311 with Low Pressure Alarm situated at the end of the main header (line - 6"-IS8B-790311-CS2-HC) to meet the steam demand.

The Main Control Panel must have at least the following monitored signals:

Equipment	Signal	Function
B-7C-2	XA-780002	General Boiler Failure
	XL-780002	Boiler on/off
B-7C-3	XA-780003	General Boiler Failure
	XL-780003	Boiler on/off
Main header	PI-780311	Control the pressure at 9.4 bar(g)

Each boiler must be supplied with two pressure safety and relief valves to be sized by vendor, according to ASME – Boiler & Pressure Vessel Code:

B-7C-2: PSV-780064 and PSV-780065;

- B-7C-3: PSV-780062 and PSV-780063;

4.3 PLANT STEAM DISTRIBUTION

4.3.1 BUILDING 7A

4.3.1.1 Low Pressure Steam Distribution

The Low Pressure Steam Distribution header feeds the Re-Heated Water System (HX-7A-1) with a Pressure Reducing. This header has the following instruments:

LINE	INSTRUMENT	FUNCTION
IS8B-790317-CS2-HC	FIT-790317	Flow Rate Indication
	PIT-790317 / PAL-790317	Pressure Indication / Low Pressure Alarm
	TIT-790317 / TAL-790317	Temperature Indication / Low temperature Alarm
	PCV-790101	Pressure Reducing Valve – self operated – pressure set @ 2.1 bar(g)
IS1B-790101-CS1-HC	PIT-790101 / PAL-790101	Pressure Indication / Low Pressure Alarm
	PSV-790101	Relief at HOLD bar(g)

The Re-Heated Water System receives low pressure steam at the following condition:

Equipment	TAG	Steam Flow Rate (Kg/h)	Required Pressure (barg)	Available Pressure (barg)	Available Temperature (ºC)
Re-Heated Water	HX-7A-1	1103.5	2	2.0	166

4.3.1.2 Medium Pressure Steam Distribution

The Medium Pressure Steam Distribution header feeds the following equipment:

Equipment	TAG	Steam Flow Rate (Kg/h)	Required Pressure (barg)	Available Pressure (barg)	Available Temperature (ºC)
Formulation Vessel TCU	TCU-3903	23.0	4	3.8	170
Autoclave	AT-9001	120.0	4	3.4	169
Autoclave	AT-9002	120.0	4	3.2	169
WFI - Heat Exchanger	TC-6401	16.5	4	3.7	169
CIP - Heat Exchanger	TC-7701	25.0	4	3.7	169

This header has the following instruments:

LINE	INSTRUMENT	FUNCTION
IS8B-790315-CS2-HC	FIT-790315	Flow Rate Indication
	PIT-790315 / PAL-790315	Pressure Indication / Low Pressure Alarm

	TIT-790315 / TAL-790315	Temperature Indication / Low temperature Alarm
	PV-790201A	Pressure Reducing Valve – self operated – pressure set @ 4.1 bar(g)
	PV-790201B	Pressure Reducing Valve – self operated – pressure set @ 4.0 bar(g)
IS4B-790201-CS1-HC	PIT-790201 / PAL-790201	Pressure Indication / Low Pressure Alarm
	PSV-790201	Relief at 5 bar(g)

4.3.1.3 High Pressure Steam Distribution

The High Pressure Steam Distribution header feeds the following equipment:

Equipment	TAG	Steam Flow Rate (Kg/h)	Required Pressure (barg)	Available Pressure (barg)	Available Temperature (ºC)
WFI Still	MES-6401	345.0	8	8.3	179
Clean Steam Generation	CSG-6501	1010.0	8	8.3	179
Tie-in	-	1305.9	9	8.9	180
Condensate Pump	PC-7A-1	18.0	8.2	8.4	179

This header has the following instruments:

LINE	INSTRUMENT	FUNCTION
IS8B-790312-CS2-HC	FIT-790314	Flow Rate Indication
	PIT-790314 / PAL-790314	Pressure Indication / Low Pressure Alarm
	TIT-790314 / TAL-790314	Temperature Indication / Low temperature Alarm

4.3.2 BUILDING 7B

The header at the entrance of the building has the following instruments:

LINE	INSTRUMENT	FUNCTION
IS8B-790319-CS2-HC	FIT-790319	Flow Rate Indication
	PIT-790319 / PAL-790319	Pressure Indication
		Pressure Alarm Low

LINE	INSTRUMENT	FUNCTION
	TIT-790319 / TAL-790319	Temperature Indication Low Temperature Alarm

4.3.2.1 Low Pressure Steam Distribution

The Low Pressure Steam Distribution header feeds the Re-Heated Water System (HX-7B-1) with a Pressure Reducing. This header has the following instruments:

LINE	INSTRUMENT	FUNCTION
IS8B-790319-CS2-HC	PIT-790327 / PAL-790327	Pressure Indication / Low Pressure Alarm
	TIT-790327 / TAL-790327	Temperature Indication / Low temperature Alarm
	PCV-790104	Pressure Reducing Valve – self operated – pressure set @ 2.1 bar(g)
IS1B-790104-CS1-HC	PIT-790104 / PAL-790104	Pressure Indication / Low Pressure Alarm
	PSV-790104	Relief at 5 bar(g)

The Re-Heated Water System receives low pressure steam at the following condition:

Equipment	TAG	Steam Flow Rate (Kg/h)	Pressure (barg)	Available Pressure (barg)	Available Temperature (ºC)
Re-Heated Water	HX-7B-1	1280.1	2	2	166

4.3.2.1 Medium Pressure Steam Distribution

The Medium Pressure Steam Distribution header feeds the following equipment:

Equipment	TAG	Steam Flow Rate (Kg/h)	Pressure (barg)	Available Pressure (barg)	Available Temperature (ºC)
Seed Bioreactor	BRE-5401-JL	5.0	4	3.9	170
Intermediate Bioreactor (TCU)	BRE-5501-JL	9.0	4	3.8	170
Production Bioreactor 1 - Jacket Loop	BRE-5601-JL	23.0	4	3.8	170

Equipment	TAG	Steam Flow Rate (Kg/h)	Pressure (barg)	Available Pressure (barg)	Available Temperature (ºC)
Production Bioreactor 2 - Jacket Loop	BRE-5602-JL	23.0	4	3.8	170
Production Bioreactor 3 - Jacket Loop	BRE-5603-JL	23.0	4	3.8	170
CIP Skid 1	CIP-7701	250.0	4	3.8	170
CIP Skid 2	CIP-7702	250.0	4	3.8	170
CIP Skid 3	CIP-7703	250.0	4	3.8	170
Autoclave	AT-9001	120.0	4	3.6	170
WFI Heaters (TC-6401 and TC-9202)	SK-6401	205.0	4	3.8	170
Parts Washer	LV-4601	205.0	4	3.7	170

This header has the following instruments:

LINE	INSTRUMENT	FUNCTION
IS8B-790321-CS2-HC	PIT-790321 / PAL-790321	Pressure Indication / Low Pressure Alarm
	TIT-790321 / TAL-790321	Temperature Indication / Low temperature Alarm
	PV-790112A	Pressure Reducing Valve – self operated – pressure set @ 4.1 bar(g)
	PV-790112B	Pressure Reducing Valve – self operated – pressure set @ 4.0 bar(g)
IS4B-790212-CS1-HC	PIT-790112 / PAL-790112	Pressure Indication / Low Pressure Alarm
	PSV-790112	Relief at 5 bar(g)

4.4 CONDENSATE COLLECTION

The condensate recovered from each building is pumped and interconnected in a single line to the deaerator, by the pumps PC-7A-1 for Building 7A and PC-7B-1 for Building 7B, located at Utilities Room. These pumps are driven with high pressure plant steam.

4.4.1 BUILDING 7A

The Steam line for the Condensate Pump Skid PC-7A-1 has the following instrument:

Location	Instrument	Function
Steam Line for Condensate Pump Skid	PI-790329	Pressure Indication

The pump PC-7A-1 has the following characteristics:

- Capacity = 2,931.0 kg/h
- Driving Fluid = High Pressure Steam – 18 kg/h @ 8.4 bar(g)
- Discharge Pressure = 1,7 bar(g)

4.4.2 BUILDING 7B

The Steam line for the Condensate Pump Skid PC-7B-1 has the following instrument:

Location	Instrument	Function
Steam Line for Condensate Pump Skid	PI-790330	Pressure Indication

The pump PC-7B -1 has the following characteristics:

- Capacity = 4,163.1 kg/h
- Driving Fluid = High Pressure Steam – 25 kg/h @ 8.4 bar(g)
- Discharge Pressure = 1,9 bar(g)