Annex Q

NORM Survey Report

NORM Survey Report

FPSO Fluminense

JAB-REL-SHE-FLU-007

Prepared by:	Eriksen Matta	Signature:	
Approved by:	Eduardo André	Signature:	
Revision:	0	Date:	05/22/2023

Jabarra Serviços de Radioproteção LTDA ME
Avenida Silvio Picanço 463, sala 404 – Charitas, Niterói, Rio de Janeiro
contato@jabarra.com.br / (21) 2510-4828 / (21) 2510-4827
www.jabarra.com.br

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0	05/22/2023	First Issue

Index

1. Introduction

NORM is an acronym formed by the first letters of the expression "Naturally Occurring Radioactive Material". This type of material might be found in certain oil production sites and a comprehensive procedure is required to properly identify, manage, transfer and treat these materials.

The presence of radionuclides from natural series of Uranium and Thorium are common in oil and gas exploration and production. The main characteristics of this occurrence are:

- There are usually no gamma equivalent dose rates with high values;
- Limited number of nuclides (mainly U and Th disintegration chains);
- Chains of long disintegration - long periods of decay;
- Inhalation and ingestion are the main concerns from the dose point of view.

The deposition of Radium (^{228}Ra, ^{226}Ra, ^{224}Ra) occurs because of the α-decay from their immediate parent (^{228}Th, ^{230}Th, ^{232}Th). In addition, Ra prefers the aqueous phase, leading to enhanced concentrations. Therefore, after production, the Ra will follow the aqueous produced water stream. Radium is chemically similar to barium (Ba), strontium (Sr), calcium (Ca) and magnesium (Mg), and it becomes incorporated into sulfate or carbonate deposition. Once deposited inside equipment or produced at the surface, all three Ra show different behavior.

- ^{228}Ra reaches secular balance with ^{228}Ac very quickly (within two days).

However, in a much slower process (about 10 years), ^{228}Th, that was absent in deposits of produced water, grows in (transient balance). With the arising of ^{228}Th all NORMs chain until ^{208}Pb appear in about two weeks.

- ^{226}Ra starts a secular balance (within two weeks) of short-lived NORMs (^{222}Rn, ^{218}Po, ^{214}Pb, ^{214}Bi and ^{214}Po) of its own. The growth of ^{210}Pb occurs in a much slower rate (about 100 years).
- ^{224}Ra appears in produced water or its deposits without its immediate parent ^{228}Th. That is why its concentration does not grow. It actually tends to disappear (within two weeks). This implies that only in samples of fresh produced water ^{224}Ra may be detected. With the reappearance of ^{228}Th, ^{224}Ra will also reappear in more aged samples.

Radon (Rn) isotopes are noble gas elements and prefer the (natural) gas phase for transport to

the surface. As ^{220}Rn only lives for a few minutes, by the time that this element reaches the surface, it will have decayed. ^{222}Rn with a half-life of about four days may appear in Liquid Natural Gas (LNG) processing installations, in the upper part of the crude oil storage tanks or in Natural Gas (NG) transmission lines. Ultimately, it will decay to ^{210}Pb, but as ^{222}Rn owns a short-life compared to 210Pb, no balance status will be reached.

In gas or oil fields, where stable Pb is present in produced waters, ^{210}Pb may be incorporated in any formed deposit as well. In this kind of deposit, ^{210}Pb activity concentrations will be higher than ^{226}Ra activity concentration, indicating that an independent mechanism for Pb transport is present.

The level of NORM accumulation can vary substantially from one facility to another, depending on geological formation and operational conditions, and will also change over the lifetime of a well. NORM cannot be differentiated immediately from other oilfield wastes, except by specific measurement. The quantity of material does not necessarily define the amount of NORM present or the radiological risk that it may represent. To determine whether or not a facility is accumulating NORM, a periodic NORM survey with subsequent sampling and analysis needs to be conducted.

2. Description of the Field

The FPSO FLUMINENSE, operated by MODEC, is located in the Bijupirá and Salema fields. The Bijupirá and Salema fields, discovered in 2003, are located on the North Fluminense coast, approximately 295 kilometers from the city of Rio de Janeiro, located in the Campos Basin, with a water depth of around 400-870 meters.

3. Objective

This document presents the results of a radiometric survey carried out on board of FPSO Fluminense operated by SHELL. The work scope included a complete radiometric survey of the oil production and water separation plant, followed by the interpretation of the results.

4. References

NORMA CNEN NN - 3.01

Diretrizes Básicas de Proteção Radiológica

NORMA CNEN NE - 3.02

Serviços de Radioproteção

NORMA CNEN NN - 8.01

Gerência de Rejeitos Radioativos de Baixos e Médios Níveis de Radiação

Lei Nº 10.308, de 20 de Novembro de 2001.

NR-37 – Segurança e Saúde em Plataformas de Petróleo

IOGP - Managing Naturally Occurring Radioactive Material (NORM) in the oil and gas industry – Report 412 – March/2016

Diretrizes para gerenciamento de materiais radioativos de ocorrência natural (NORM) / Instituto Brasileiro de Petróleo, Gás e Biocombustíveis. – Rio de Janeiro: IBP, 2019.

Plano de Proteção Radiológica - FPSO Fluminense - Revisão 02 de 24/10/2022.

Plano de Gerenciamento de Resíduos NORM - FPSO Fluminense - Revisão 03 de 21/03/2023.

5. Equipment

In order to carry out this radiometric survey for NORM presence, on the oil production and water separation plant, it was used a Scintillator radiation meter (model: Ludlum 3001), which is capable of distinguish the different radiations and energy that are emitted from the homogeneous material.

The annual Calibration Certificate and equipment data can be found in Annex B of this Report.

6. Radiometric Survey

In this part of the procedure, the process involved in the monitoring task of the oil production and water separation plant will be presented.

6.1. Equipment Checklist

Before carrying out the work, it is necessary to make a checklist of all the devices to be used in the following tasks:

- Radiation meter;
- Test source for admeasuring the radiation meter;
- Forms.

6.2. Radiation Meter Operation Test

The test of the radiation meter relays on the following steps:

1) Check if the radiation meter battery is charged and the calibration certificate is updated.
2) Choose the monitoring mode in terms of reading speed (slow / fast) and select the scale to be used (x0.1; x1.0; x10; x100).
3) Using the test source, “read” it in the standard condition to determine the standard value. This standardization procedure should be performed only once, right after the calibration of the radiation meter. The measurement of the standard condition should be made by touching the radiation meter against the open test source, making 3 (three) measurements and averaging them.
4) Standard condition is the measurement made at a given distance and position from the detector in relation to the test source during the reading time.
5) Standard value is the measure of the exposure rate or equivalent dose rate in the standard condition and should be used as a reference value for comparing the next measurements,
6) Using the test source, perform the reading process in the standard condition;
7) Compare the reading performed with the standard value, if the deviation found is equal to or less than 20% of the standard value, the equipment (radiation meter) is suitable for use. Otherwise, the radiation meter must be sent for maintenance and new calibration, as it is outside the acceptance range;
8) Record the reading as well as the data related to the equipment (radiation meter) on the function/operation test form.

6.3. Radiometric Survey on Equipment

The radiometric survey of the equipment demonstrated in item 6 of this Monitoring Report must follow the general steps described below:

1) Check if the radiation meter battery is charged and the calibration certificate is updated.
2) Choose an appropriate scale, taking into account that the values read correspond to the chosen scale.
3) Perform the Radiation Meter test, using the Cs-137 test source.
4) Check if the deviation between the measured value and the standard value is within the range (± 20%).
5) Perform the background radiation measurement, approximately 2 (two) meters from the equipment. At this stage, it is necessary to ensure that, when measuring the bottom, there is no other radiation source that affects the monitoring result.
6) Take the respective readings along the entire length of the equipment / line, filling out the form provided.
7) Archive the measured readings in standard report format.

7. Results

The radiometric survey was performed on 3rd May, 2023. The table below presents the maximum values found for equivalent dose rate in each of the equipment/lines.

Table 1 - Results of monitoring carried out at the production plant

TAG	Equipment	Local	PI&D	05/03/2023		
				Radiation meter equipment: Ludlum 3001 (Scintillator)		
				Surface (µSv/h)	1 meter (µSv/h)	Background (µSv/h)
HBG-1050	Salema Inlet Heater	Module 1	20-0103	0,07	0,07	0,07
16"-PF-B1-1001	Inlet	HBG-1050 Inlet	20-0103	0,67	0,10	0,07
2"DC-A-5009	Closed Drain	HBG-1050	20-0103	0,07	0,07	0,07
16"PF-A-1007	Outlet	from HBG-1050 to MBD-1010	20-0103	0,07	0,07	0,07
MBD-1010	Salema Production Separator	Module 1	20-0103	0,07	0,07	0,07
16"PF-A-1007	Inlet	from HBG-1050	20-0103	0,07	0,07	0,07
2"PW-A-2003	PW Inlet	from MBM-3610 to MBD-1010	20-0103	0,07	0,07	0,07
3"PW-A-2003	PW Inlet	from MBM-3610 to MBD-1010	20-0103	0,07	0,07	0,07
4"DC-A-5001	Closed Drain	MBD-1010	20-0103	0,47	0,08	0,07
4"DC-A-5002	Closed Drain	MBD-1010	20-0103	0,07	0,07	0,07
HBG-1055	Bijupirá Inlet Heater	Module 1	20-0104	0,26	0,16	0,07

TAG	Equipment	Local	PI&D	05/03/2023		
				Radiation meter equipment: Ludlum 3001 (Scintillator)		
				Surface (µSv/h)	1 meter (µSv/h)	Background (µSv/h)
16"-PF-B1-1000	Inlet	HBG-1055 Inlet	20-0104	0,58	0,12	0,07
2"DC-A-5010	Closed Drain	HBG-1055 Inlet	20-0104	0,10	0,07	0,07
16"PF-A-1009	Outlet	from HBG-1055 to MBD-1015	20-0104	0,62	0,14	0,07
MBD-1015	Bijupirá Production Separator	Module 1	20-0104	0,09	0,07	0,07
16"PF-A-1009	Inlet	from HBG-1055	20-0104	0,51	0,09	0,07
2"PW-A-2007	PW Inlet	from MBM-3610 to MBD-1015	20-0104	0,07	0,07	0,07
3"PW-A-2007	PW Inlet	from MBM-3610 to MBD-1015	20-0104	0,19	0,08	0,07
4"DC-A-5004	Closed Drain	MBD-1015	20-0104	0,84	0,07	0,07
4"DC-A-5005	Closed Drain	MBD-1015	20-0104	0,07	0,07	0,07
8"PW-A-2004	PW Outlet	from MBM-1015 to MBD-3610	20-0104	0,59	0,11	0,07
HBG-1060	Test Inlet Heater	Module 1	20-0105	0,07	0,07	0,07
10"-PF-B1-1002	Inlet	HBG-1060 Inlet	20-0105	0,14	0,07	0,07
2"DC-A-5011	Closed Drain	HBG-1060 Inlet	20-0105	0,08	0,07	0,07
10"PF-A-1011	Outlet	from HBG-1060 to MBD-1020	20-0105	0,07	0,07	0,07
MBD-1020	Test Production Separator	Module 1	20-0105	0,10	0,07	0,07
10"PF-A-1011	Inlet	from HBG-1060	20-0105	0,07	0,07	0,07
2"PW-A-2011	PW Inlet	from MBM-3610 to MBD-1020	20-0105	0,07	0,07	0,07
3"PW-A-2011	PW Inlet	from MBM-3610 to MBD-1020	20-0105	0,07	0,07	0,07
4"DC-A-5007	Closed Drain	MBD-1020	20-0105	0,50	0,08	0,07
4"DC-A-5008	Closed Drain	MBD-1020	20-0105	0,07	0,07	0,07
4"PW-A-2008	PW Outlet	from MBM-1020 to MBD-3610	20-0105	0,77	0,09	0,07
MBM-3610	Water Collection / Skim Vessel	Module 1/2	20-0121	0,11	0,07	0,07
8"PW-A-2004	Inlet	From Separators	20-0121	1,04	0,13	0,07
4"PW-A-2008	Inlet	From Test Separator	20-0121	0,42	0,11	0,07
6"PW-A-2023	Bypass	From Separators	20-0121	0,40	0,12	0,07
8"PW-A-2025	Outlet	From MBM-3610 to ZBM-3620	20-0121	0,65	0,13	0,07
3"PW-A-2003	Sand Jet Line	From MBM-3610 to MBD-1010	20-0121	0,10	0,07	0,07
2"DC-A-5075	Closed Drain	MBM-3610	20-0121	0,09	0,07	0,07
2"PW-A-2013	Outlet	From MBM-3610 to HBG-1110	20-0121	0,23	0,07	0,07
2"DC-A-5060	Closed Drain	From MBM-3610	20-0121	0,23	0,07	0,07
ZBM-3620	Hydrocyclone	Module 2	20-0122	0,46	0,13	0,07
8"PW-A-2044	Inlet	From MBM-3610	20-0122	0,20	0,07	0,07

TAG	Equipment	Local	PI&D	05/03/2023		
				Radiation meter equipment: Ludlum 3001 (Scintillator)		
				Surface (µSv/h)	1 meter (µSv/h)	Background (µSv/h)
8"PW-A-2045	Bypass	Bypass	20-0122	0,22	0,07	0,07
8"PW-A-2047	Outlet	from ZBM-3620 to MBM-3630	20-0122	0,97	0,17	0,07
2"PW-A-2046	Outlet	to 2"DC-A	20-0122	0,10	0,07	0,07
PDI-1110-1	Basket Strainer	Module 2	20-0106	0,59	0,11	0,07
12"PL-A-1112	Inlet	from BGC first stage	20-0106	0,42	0,09	0,07
8"PL-A-1113	Inlet	from Basket Strainer to HBG-1110A	20-0106	0,59	0,11	0,07
HBG-1110A	Crude/Crude Exchanger	Module 2	20-0106	0,26	0,16	0,07
HBG-1110B	Crude /Crude Exchanger	Module 2	20-0106	0,52	0,21	0,07
HBG-1115	Crude Heater	Module 2	20-0106	0,14	0,12	0,07
MBD-1125	IP Separator	Module 2/3	20-0107	0,10	0,07	0,07
2"PL-A-1188	Outlet	Offspec tanks	20-0107	0,23	0,13	0,07
4"DC-A-5024	Closed Drain	MBD-1125	20-0107	0,24	0,08	0,07
4"PW-A-2044	Outlet	to 3"PW-A-2045	20-0107	0,24	0,09	0,07
3"PW-A-2045	Outlet	to MBM-3610	20-0107	0,29	0,12	0,07
KJA-1125	IP separator pumps filter	-	20-0107	0,10	0,07	0,07
PBA-1125A	Produced water drain pumps	-	20-0107	0,12	0,07	0,07
PBA-1125B	Produced water drain pumps	-	20-0107	0,09	0,07	0,07
ZBM-3630	Flotation Cell	Module 2	20-0123	0,07	0,07	0,07
8"PW-A-2047	Inlet	from ZBM-3620 to MBM-3630	20-0123	1,26	0,07	0,07
8"PW-A-2037	Outlet	from MBM-3630 to HBG-3650	20-0123	1,15	0,23	0,07
4"DC-A-5050	Closed Drain	MBM-3630	20-0123	0,56	0,12	0,07
4"DC-A-5049	Closed Drain	MBM-3630	20-0123	0,23	0,12	0,07
PBA-3550A	Flotation Cell Pump	Module 2	20-0123	0,14	0,07	0,07
6"PL-A	Inlet	Circulation	20-0123	0,21	0,13	0,07
4"PL-A	Outlet	Circulation	20-0123	0,43	0,12	0,07
PBA-3550B	Flotation Cell Pump	Module 2	20-0123	0,17	0,07	0,07
6"PL-A	Inlet	Circulation	20-0123	0,21	0,13	0,07
4"PL-A	Outlet	Circulation	20-0123	0,46	0,12	0,07
HBG-3650	Produced Water Cooler	Module 2	20-0123	0,38	0,22	0,07
8"PW-A-2043	Inlet	from MBM-3630 to HBG-3650	20-0123	0,30	0,25	0,07
10"PW-A-2033	Outlet	Water Overboard	20-0123	0,61	0,14	0,07
8"PW-A-2099	Bypass	Bypass	20-0123	0,44	0,14	0,07

TAG	Equipment	Local	PI&D	05/03/2023		
				Radiation meter equipment: Ludlum 3001 (Scintillator)		
				Surface (µSv/h)	1 meter (µSv/h)	Background (µSv/h)
MBK-1140A	Electrostatic Treater	Module 3	20-0108	0,07	0,07	0,07
10"PL-A-1141	Inlet	from MBD-1125	20-0108	0,16	0,07	0,07
10"PL-A-1129	Outlet	to Crude Exchangers	20-0108	0,07	0,07	0,07
3"PL-A-1189	Outlet	to Offspec Tanks	20-0108	0,07	0,07	0,07
3"PW-A-2014	Outlet	to Oil Treater Water Pumps	20-0108	0,44	0,07	0,07
6"PG-A-1215	Outlet	to FGC first stage	20-0108	0,07	0,07	0,07
4"DC-A-5026	Closed Drain	MBK-1140A	20-0108	0,38	0,07	0,07
MBK-1140B	Electrostatic Treater	Module 3	20-0109	0,07	0,07	0,07
10"PL-A-1142	Inlet	from MBD-1125	20-0109	0,33	0,07	0,07
10"PL-A-1132	Outlet	to Crude Exchangers	20-0109	0,07	0,07	0,07
4"DC-A-5032	Closed Drain	MBK-1140B	20-0109	0,16	0,07	0,07
3"PW-A-2015	Outlet	to Oil Treater Water Pumps	20-0109	0,36	0,07	0,07
2"PL-A-1192	Outlet	to Offspec Tanks	20-0109	0,07	0,07	0,07
6"PG-A-1218	Outlet	to 8"PG-A-1215	20-0109	0,07	0,07	0,07
8"PG-A-1215	Outlet	to FGC first stage	20-0109	0,07	0,07	0,07
PBA-1145A	Oil Treater Water Pump	Module 3	20-0108	0,07	0,07	0,07
3"PW-A-2014	Inlet	from Electrostatic Treater	20-0108	0,07	0,07	0,07
2"PW-A-2012	Outlet	to Crude / Crude Exchanger	20-0108	0,07	0,07	0,07
1"DC-A-5030	Clodsed Drain	PBA-1145A	20-0108	0,07	0,07	0,07
PBA-1145B	Oil Treater Water Pump	Module 3	20-0108	0,07	0,07	0,07
3"PW-A-2015	Inlet	from Electrostatic Treater	20-0108	0,08	0,07	0,07
2"PW-A-2018	Outlet	to Crude / Crude Exchanger	20-0108	0,07	0,07	0,07
1"DC-A-5029	Clodsed Drain	PBA-1145B	20-0108	0,10	0,07	0,07
PBA-1145C	Oil Treater Water Pump	Module 3	20-0108	0,07	0,07	0,07
3"PW-A-2016	Inlet	from Electrostatic Treater	20-0108	0,11	0,07	0,07
2"PW-A-2017	Outlet	to Crude / Crude Exchanger	20-0108	0,07	0,07	0,07
1"DC-A-5028	Clodsed Drain	PBA-1145C	20-0108	0,07	0,07	0,07
2"PW-A-2019	Outlet	to Crude / Crude Exchanger	20-0108	0,07	0,07	0,07
ABH-3410	Closed Drain Sump Tank	Module 10	20-0124	0,28	0,07	0,07
6"DC-D-5051	Inlet	from Closed Drains	20-0124	0,10	0,07	0,07
3"PW-A-2035	Inlet	from MBM-3610	20-0124	0,07	0,07	0,07
6"PL-A-1160	Outlet	to Closed Drain Sump Pumps	20-0124	0,27	0,07	0,07

TAG	Equipment	Local	PI&D	05/03/2023		
				Radiation meter equipment: Ludlum 3001 (Scintillator)		
				Surface (µSv/h)	1 meter (µSv/h)	Background (µSv/h)
PBE-3415A	Oil Treater Water Pump	Module 3	20-0124	0,07	0,07	0,07
4"PL-A-1161	Inlet	from ABH-3410	20-0124	0,22	0,07	0,07
3"PL-A-1162	Outlet	to MBM-3610	20-0124	0,15	0,07	0,07
4"PL-A-1154	Outlet	to MBM-3610	20-0124	0,15	0,07	0,07
4"PL-A-1164	Outlet	to Crude / Crude Exchanger	20-0124	0,07	0,07	0,07
PBE-3415B	Oil Treater Water Pump	Module 3	20-0124	0,07	0,07	0,07
4"PL-A-1160	Inlet	from ABH-3410	20-0124	0,38	0,07	0,07
3"PL-A-1154	Outlet	to MBM-3610	20-0124	0,09	0,07	0,07
4"PL-A-1154	Outlet	to MBM-3610	20-0124	0,15	0,07	0,07
4"PL-A-1164	Outlet	to Crude / Crude Exchanger	20-0124	0,07	0,07	0,07
PBE-1210	Flowline Circulation Pump	Module 2	20-0147	0,07	0,07	0,07
10"PL-A-1143	Inlet	from MBD-1125	20-0147	0,07	0,07	0,07
8"PL-B-1100	Outlet	to Incoming Test Line	20-0147	0,07	0,07	0,07

8. Conclusion

In 2007, the International Commission on Radiological Protection (ICRP) recommended a public dose (risk) limit of 1 mSv/y additional to the natural background dose (~2.4 mSv/year). Ordinary gas and oil industry workers are treated as a member of the public with a limited exposure time (2,000 h/year). These recommendations have been implemented in the International Atomic Energy Agency (IAEA) Basic Safety Standards (BSS).

Taking in consideration that the Radiometric Survey is the first step to confirm the presence of NORM, for this specific scope of work, any results that does not meet with the stablished criteria should indicate the presence of NORM on the area/surface/equipment in question.

Section 7 of this report presents the results of the Radiometric Survey for all equipment selected by offshore and onshore workers. Therefore, considering the measurements performed, as well as the unit's history, several devices had an equivalent dose rate considerably higher than the background radiation level (background), which indicates the presence of NORM inside.

The P&IDs of the equipments of interest are marked to betters illustrate the survey, those P&IDs can be found on ANNEX C of this report.

For the purpose of controlling exposures to ionizing radiation, as well as controlling the generation of radioactive waste, the equipments in item 7 with an indication of the presence of NORM is considered equipment of interest for collecting samples to characterize the waste.

In order to comply with the Brazilian CNEN 8.01 standard, the results of the collected samples must confirm whether the concentration of activity found in the product is within the limit for unconditional disposal or if the oily sludge must be treated as NORM.

ANNEX A – Radiation Meter Calibration Certificate

Universidade do Estado do Rio de Janeiro
Instituto de Biologia Roberto Alcântara Gomes
Laboratório de Ciências Radiológicas

Acreditado pela CGCRE / INMETRO
Certificado pelo CASEC/IRD/CNEN

CERTIFICADO DE CALIBRAÇÃO

LCR - 0436/2022
Número de Certificado

CAL 0625

SOLICITANTE

Nome: 1029 - Jabarra Serviços e Comércio Ltda
CNPJ: 09.066.134/0001-80
Endereço: Rua Madre Maria Victoria , N° 90, Charitas – Niteroi – RJ

IDENTIFICAÇÃO DO INSTRUMENTO DE MEDIÇÃO / PADRÃO

Tipo: Câmara de ionização
Fabricante: PTW – Freiburg
Modelo: TN32002
Série: 489
Rastreabilidade: *Rastreado ao LNMRI/ IRD/ CNEN*
Última calibração realizada em 04/11/2021 – Certificado LNMRI 1042/2021. (de acordo com a norma ISO 4037-2, o intervalo de tempo entre calibrações não deve exceder 3 anos)

Tipo: Câmara de ionização
Fabricante: PTW – Freiburg
Modelo: N23361
Série: 292
Rastreabilidade: *Rastreado ao LNMRI/ IRD/ CNEN*
Última calibração realizada em 04/11/2021 – Certificado LNMRI 1043/2021. (de acordo com a norma ISO 4037-2, o intervalo de tempo entre calibrações não deve exceder 3 anos)

IDENTIFICAÇÃO DO INSTRUMENTO CALIBRADO

Tipo: Cintilômetro
Fabricante: Ludlum Measurements Inc
Modelo: 3001
Série: 25019874
Sonda: Ludlum 44-2, n° de série PR-387429

LCR- Rua São Francisco Xavier 524 Pavilhão Haroldo Lisboa da Cunha Sala 136 Térreo. Maracanã. RJ
Tel: 2334-0725 / 26 / 27 - e-mail: labmetro.uerj@gmail.com – site: www.labmetroonline.com.br

CERTIFICADO DE CALIBRAÇÃO

Acreditado pela CGCRE / INMETRO
Certificado pelo CASEC/IRD/CNEN

Laboratório de calibração acreditado pela Cgcre de acordo com a ABNT NBR ISO/IEC 17025, sob número CAL 0625

LCR. 0436/2022
Número de Certificado

CONDIÇÕES DA CALIBRAÇÃO

Geometria: Eixo longitudinal do detector coincidente com o feixe de radiação.
Ponto de referência: Centro geométrico do detector.
Fonte de radiação: ^{137}Cs.
Faixa de temperatura: 18 a 26 °C.
Faixa de pressão: 970 a 1050 hPa.
Faixa de umidade relativa do ar: 30 a 75 %.

MÉTODO E PROCEDIMENTOS DE CALIBRAÇÃO

Método utilizado: Método de Calibração em Campo de Radiação Conhecido (norma ISO 4037).
Fonte utilizada: ^{137}Cs.
Procedimentos utilizados:

1- LABMETRO-PT-003- Calibração de Monitores de Radiação dos tipos: Geiger Müller, Proporcional, Cintilômetro e Câmara de Ionização com Fonte Gama.
2- LABMETRO- PT-009- Avaliação da Incerteza de Medição.
3- LABMETRO-DQ-081 – Modelo de Certificado de Calibração Gama
4- O equipamento foi calibrado em um campo de referência caracterizado em taxa equivalente de dose ambiente $H^*(10)$.

INFORMAÇÕES ADMINISTRATIVAS

Ordem de serviço LCR/Labmetro: 279-001/2022
Laboratório responsável pela calibração: Labmetro/LCR

INFORMAÇÕES

1- O Laboratório de Ciências Radiológicas possui Certificação para Calibração de Instrumentos com Radiação Gama e X, Calibração de Monitores de Contaminação Beta, Calibração de Câmara Poço para Braquiterapia e Irradiação de Monitores Individuais na Grandeza Hp(10) e com Radiação Gama e X, concedida pelo Comitê de Avaliação de Serviços de Ensaios e Calibração (CASEC) do Instituto de Radioproteção e Dosimetria (IRD) da Comissão Nacional de Energia Nuclear (CNEN) de acordo com as recomendações do documento RT-LCI-001/2011 *(Requisitos técnicos para Certificação de Laboratório de Calibração de Instrumentos de Medição para Radiação Ionizante usados em Radioproteção).*

2- Devido às características do equipamento recomenda-se que o mesmo seja recalibrado periodicamente ou caso ocorra quaisquer danos ou alterações que possam modificar sua resposta.

3- O presente certificado de calibração atende aos requisitos da norma NBR ISO/IEC 17025 e é válido apenas para o instrumento de medição e condições especificadas acima, não sendo extensivo a quaisquer outros instrumentos. O presente certificado de calibração só poderá ser reproduzido por completo, não sendo autorizada cópia de partes do mesmo.

4- De acordo com o documento RT-LCI-001/2011 a calibração foi realizada a 50 % de cada uma das escalas. Os valores medidos devem se situar dentro de ±10 % do valor de referência.

CERTIFICADO DE CALIBRAÇÃO

Acreditado pela CGCRE / INMETRO
Certificado pelo CASEC/IRD/CNEN

Laboratório de calibração acreditado pela Cgcre de acordo com a ABNT NBR ISO/IEC 17025, sob número CAL 0625

LCR. 0436/2022
Número de Certificado

RESULTADOS

As incertezas padrão expandidas declaradas neste certificado foram calculadas de acordo com as recomendações do GUM (Guia para a Expressão da Incerteza de Medição - Avaliação de Dados de Medição, INMETRO), para um fator de abrangência k = 2, com nível de confiança de aproximadamente 95 %.

Valor de referência	Medida do instrumento		Incerteza expandida U (%)
Taxa de equivalente de dose ambiente H*(10)	Antes do ajuste	Depois do ajuste	
5,00 $\mu Sv/h$	5,48 µSv/h	Sem ajustes	5,8
25,0 $\mu Sv/h$	26,8 µSv/h	Sem ajustes	5,8
250 $\mu Sv/h$	243 µSv/h	Sem ajustes	5,8

OBS: O ajuste, quando necessário, não faz parte do escopo da acreditação do laboratório.

Data da calibração: 31 de maio de 2022

Data da emissão do certificado de calibração: 03 de junho de 2022

Técnico Executor: Márcio Alexandre Costa Cruz

Certificado emitido por:

Vanessa Mondaini de Castro
Responsável Técnico Radioproteção

Validado em 06/06/2022
Responsável: Pedro Costa

ANNEX B – Radiation Meter Operation Test

	Jabarra Radioproteção	
	FOR-JAB-BRA-011 **Teste de Funcionamento de Medidores de Radiação**	Pág: 1 de 1 Revisão: B

Medidor de Radiação	**Fonte Teste**
Marca: Ludlum	Radioisótopo: Cs - 137
Modelo: 3001	Atividade: 220 KBq
Número de série: 25019874	Número de série: 59S11
Certificado de Calibração: 436/2022	Data da Atividade: 25/04/2011
Laboratório: LCR	
Data de Emissão: 31/05/2022	

Foto da posição da sonda para medida padrão

Valor Padrão: 3,08 (µSv/h)	
Limite Superior:	3,70
Limite Inferior:	2,47

Data	**Valor medido (µSv/h)**	**Responsável**	**Assinatura**
08/08/22	3,08	Pedro Eugenio	Pedro
26/08/22	3,22	Pedro Costa	
15/11/22	3,13	Eduardo Andrade	
19/12/22	2,72	Pedro Eugenio	Pedro
30/01/23	2,82	Pedro Eugenio	Pedro
24/04/23	3,40	Victor Tim	
01/05/23	3,14	Eduardo Andrade	

ANNEX C – Marked P&IDs

PBA-1145A/B/C

OIL TREATER WATER PUMPS
CAPACITY: 4m³/hr (18 gpm) @ △P = 690 kPa (100 psi)
DRIVER : 7.5 kW (10 hp)

MBK-1140A

ELECTROSTATIC TREATER
VESSEL SIZE: 3050 mm (120") O.D. x 15,240mm (50'-0") S/S
DOME SIZE: 610 mm O.D. x 2,029 S/S
DESIGN: 345 kPag (50 psig) @ 93° (200°F)
OPERATING: 90 kPag (13 psig) @ 66°C (150°F)
TRANSFORMER RATING: 75 kW

16

20-0106 10"-PL-A-1129 TO CRUDE EXCHANGERS

20-0107 10"-PL-A-1141 FROM IP SEPARATOR

INSTRUMENT AIR SUPPLY DWG. 20-0153

2"-IA-M-3003

1"-IA-M-3003

1/2"G6SDS TO INSTRUMENTS (AS REQUIRED)

20-0107 1"-FG-B 1" TUBING 316SS STARTUP GAS FROM IP SEPARATOR

LCP 1160 001A RECEIVER CABINET

AE 1160 001A GRAB SAMPLER

10"-PL-A-1129 TO CRUDE EXCHANGERS

10"A7RY

2"-PG-A-1214

6"-FL-A-4107

6"-FL-A-4106

4"x6" SET @ 345 kPag 61.2 CM² ORIFICE

4"-PG-A-1213

4"-PG-A-1212

4"-PL-A-1181

10"-PG-A-1211

24"

10"

SPECTACLE BLIND

BLEED RING

LAH LAL LAHH LALL

PAHH PALL

PAH PAL

PSH PSL

LAH START LAL STOP

LAHH LALL

TSH 88°C

75 KVA TRANSFORMER

MCC

FLOAT SWITCH

SAMPLE SINK

SAMPLE POINT

HOSE

CORROSION COUPON

ANODES

NOTE 1

LIQUID LEVELS:	OIL/GAS	OIL/WATER INTERFACE
LAHH –	4803	711
LAH –	4574	660
NLL –	4117	559
LAL –	3812	483
LALL –	3660	432

20-0106 2"-PW-A-2012 TO CRUDE / CRUDE EXCHANGER

4"-DC-A-5026

4"-DC-A-5027

2"-PW-A-2019

3"-PW-A-2014

2"-PW-A-2012

2"-PW-A-2018

2"-PW-A-2017

3"-PW-A-2015

3"-PW-A-2016

1"-DC-A-5030

1"-DC-A-5029

1"-DC-A-5028

2"-DC-A-5031

TO CLOSED DRAIN DWG. 20-0124

TO OPEN DRAIN HEADER DWG. 20-0125

FROM LIC-1140B-2 20-0109

FROM ELECTROSTATIC TREATER "B" 20-0109

4"-PG-A-1275 TO ELECTROSTATIC TREATER "B" 20-0109

6"-PG-A-1215 TO ELECTROSTATIC TREATER "B" 20-0109

STARTUP GAS TO ELECTROSTATIC TREATER "B" 20-0109

6"-FL-A-4107 TO LP FLARE HEADER 20-0109

3"-PL-A-1189 TO ELECTROSTATIC TREATER "B" 20-0109

0,15 0,16 0,17 0,20 0,38 0,43 0,18 0,26 0,44

NOTE:

THIS WORK HAS BEEN DEVELOPED BY A PIPING DESIGNER AND CONTEMPLATES PIPING VISUAL INSPECTION, FLANGES, VALVES, AND INSTRUMENTS CONNECTIONS. THE LOGICAL SYSTEM VERIFICATION AND ALSO ELETRIC SYSTEM ARE NOT INCLUDED.

NOTES:

1. LIQUID LEVELS MEASURED FROM BOTTOM OF VESSEL
2. DELETED

■ Indicativo de NORM
■ Sem indicativo de NORM
■ Sem acesso

Todas as medidas estão em µSv/h

PBA-1145A PBA-1145B PBA-1145C

MODULE 3

CONFIDENTIAL PROPRIETARY INFORMATION

NO.	BY	REVISION DESCRIPTION	DATE	CHK'D.	APPV'D.
14	MSA	AS BUILT & REMOVED CLOUDS	05/12/12	MSA	LD/RD
13	HGF	AS BUILT/REVISED AS NOTED	10/05/10	MH	CCP
12	MMS	AS-BUILT	09/01/09	VANTUIL	DEUZIMAR
16	RSN	REVISED ACCORDING MOC 1050	16/03/17	TL/VL	TL/VL
15	RSN	REVISED ACCORDING MOC 975/976	04/02/16	DE	JG

CLIENT: ENTERPRISE OIL — Bijupira & Salema

DRAWN BY: CH
DWG DATE:
DWG SCALE: NONE
AT D SIZE
SHEET:
CAD FILE: 01-20-0108

MODEC INTERNATIONAL LLC

PROJECT: BIJUPIRA & SALEMA FIELDS DEVELOPMENT

TITLE: PIPING & INSTRUMENTATION DIAGRAM ELECTROSTATIC TREATER "A"

DWG NO: 1058-AE-20-90-20-0108

REV: 16

MBK-1140B

ELECTROSTATIC TREATER
SIZE: 3050 mm (120") O.D. x 15,240mm (50'-0") S/S
DOME SIZE: 610 mm O.D. x 2,029 S/S
DESIGN: 345 kPag (50 psig) @ 93° (200°F)
19 OPERATING: 90 kPag (13 psig) @ 66°C (150°F)
TRANSFORMER RATING: 75 kW

TO LP FLARE SYSTEM DWG. 20-0120

20-0108 6"-PG-A-1215 FROM ELECTROSTATIC TREATER "A"

20-0108 4"-PG-A-1275 FROM ELECTROSTATIC TREATER "A"

20-0108 6"-FL-A-4107 FROM ELECTROSTATIC TREATER "A"

20-0106 10"-PL-A-1132 TO CRUDE EXCHANGER

20-0107 10"-PL-A-1142 FROM IP SEPARATOR

20-0108 STARTUP GAS 1" TUBING 316SS FROM ELECTROSTATIC TREATER "A"

20-0108 TO LY-1140B-2

20-0108 3"-PW-A-2015 TO TREATER WATER PUMPS

4"-PL-A-1276
2"-FL-A-4110
4"-PG-A-1275
8"-FL-A-4109
6"-PG-A
2"-PG-A-1219
6"-FL-A-4108
4"-PG-A-1216
4"-PG-A-1217
2"-PG-A-1218
4"-PL-A-1183
4"-DC-A-5032
4"-DC-A-5033
4"-PG-A-1189
2"-PL-A-1192
2"-PG-A-1220 20-0123 FROM FLOTATION CELL
8"-PG-A-1215 20-0110 TO FGC 1st STAGE
3"-PL-A-1189 20-0123 TO OFFSPEC TANKS

LCP 1160 001B RECEIVER CABINET
AE 1160 001B GRAB SAMPLER
FQI 1160B
TT 1160 001B
TE 1160 001B
PT 1160 001B
FT 1160 001B
FC 1160 001B
PY 1140B-1
PV 1140B-1
AP 1160 001B
ZIO 1140B-1
ZIC 1140B-1
DI ESD
ZSO 1140B-1
ZSC 1140B-1
SDY 1140B-1
SDV 1140B-1
FI 1140B-1
FE 1140B-1
PV 1140B-3
PY 1140B-3
SET @ 69 kPag PIC 1140B-1 PAH PAL
AO PCS
AI PCS
PT 1140B-1
LY 1140B-1
LV 1140B-1
TI 019R
TI 020R
PIPE TUBING ½"x3/8"
FQI 1125-1 E-HOUSE
PT 1140B-4
FT 1140B-2L
FT 1140B-2
TT 1140B-2
TE 1140B-2
TW 1140B-2
FP 1140B-2
FE 1140B-2 (NOTE 5)
AY 1140B-2 (NOTE 4)
PT 1140B-2
PV 1140B-2
PDY 1140B-2
PY 1140B-2
0109 P-311 MODULE 3 PIPERACK
PIC 1140B-2 PAH 50%-100%
0%-50%
SDY 1140B-2
SDV 1140B-2
SDY 1140B-3
SDV 1140B-3
ZIO 1140B-3
ZIC 1140B-3
ZSO 1140B-3
ZSC 1140B-3
DI ESD
(NOTE 3)
LIC 1140B-1 LAH LAL
LT 1140B-3
LI 1140B-3
LG 1140B-1A
LT 1140B-1
LAHH LALL
PI 1140B-3 PAHH PALL
PT 1140B-3
PI 1140B-1
TI 021R
PSV 1140B-1
PSV 1140B-2
SP 10 BLEED RING
SP 81 SPECTACLE BLIND
SP 82 SPECTACLE BLIND
SP 17 BLEED RING
SP 83 SPECTACLE BLIND
SP 89 SPECTACLE BLIND
SP 81 SPECTACLE BLIND
SP 183 CORROSION COUPON
SP 7 SAMPLE POINT
TSH 1140B- 88°C
MBK 1140B-2
MBK 1140B-1
MCC
SS 1140B-1 START
SS 1140A-2 STOP
XI 1140B-2
XI 1140B-1
75 KVA TRANSFORMER
TI 1140B-1
AI PCS
TT 1140B-1
LIC 1140B-2 LAH STOP LAL START
TI XXXX-X
LT 1140B-4
LI 1140B-4 LAHH LALL
LT 1140B-2
SAMPLE SINK
FLOAT SWITCH LS 1140B-1 (F)
24" MW
ANODES
LIQUID LEVELS:

	OIL/GAS	OIL/WATER INTERFACE
LAHH	4803	711
LAH	4574	660
NLL	4117	559
LAL	3812	483
LALL	3660	432

NOTE 1

MBK-1140B

0,33 0,12 0,15 0,21 0,10 0,16 0,10 0,36 0,17

NOTE:
THIS WORK HAS BEEN DEVELOPED BY A PIPING DESIGNER AND CONTEMPLATES PIPING VISUAL INSPECTION, FLANGES, VALVES, AND INSTRUMENTS CONNECTIONS. THE LOGICAL SYSTEM VERIFICATION AND ALSO ELETRIC SYSTEM ARE NOT INCLUDED.

NOTES:
1. LIQUID LEVELS MEASURED FROM BOTTOM OF VESSEL.
2. DELETED.
3. THE ACTUADOR NOT IS INSTALLED YET, THIS VALVE IS BEING OPERATED MANUALLY.
4. INSTRUMENTATION VALVE ACCORDING TO SPECIFICATION 0381-MI20-00S1-0090.
5. FOR MORE DETAILS CHECK 5004-ODS20-9020-0016.

TO CLOSED DRAIN DWG. 20-0124
TO OPEN DRAIN DWG. 20-0125

MODULE 3

CONFIDENTIAL
PROPRIETARY INFORMATION

Indicativo de NORM
Sem indicativo de NORM
Sem acesso
Todas as medidas estão em µSv/h

NO.	BY	REVISION DESCRIPTION	DATE	CHK'D.	APPV'D.
16	MSA	AS-BUILT IN ACCORDANCE WITH SHUTDOWN	15/01/14	MSA	GBT
15	MSA	AS BUILT & REMOVED CLOUDS	05/03/13	MSA	LB/RD
19	RSN	REVISED ACCORDING MOC 1050	16/03/17	TL/VL	TL/VL
18	RSN	REVISED ACCORDING MOC 975/976	05/02/16	DE	JC
17	RSN	REVISED ACCORDING MOC 874	07/10/15	VA	VA

CLIENT: ENTERPRISE OIL / Bijupira & Salema

DRAWN BY: CH
DWG DATE:
DWG SCALE: NONE AT D SIZE
SHEET:
CAD FILE: 01-20-0109

MODEC INTERNATIONAL LLC
PROJECT: BIJUPIRA & SALEMA FIELDS DEVELOPMENT
TITLE: PIPING & INSTRUMENTATION DIAGRAM ELECTROSTATIC TREATER "B"
DWG NO.: 1058-AE-20-90-20-0109
REV.: 18

MBM-3610

WATER COLLECTION / SKIM VESSEL

SIZE: 1830 mm (72") O.D. x 7620 mm (25') S/S
DESIGN 1896kPag (275 psig) @ 60°C (140°F)
OPERATION: 690 kPag(100 psig) @ 41°C (105°F)
CAPACITY: 331 m³/h (WATER) (50,000 bpd)

🟥 Indicativo de NORM
🟩 Sem indicativo de NORM
🟦 Sem acesso
Todas as medidas estão em µSv/h

NOTE:

THIS WORK HAS BEEN DEVELOPED BY A PIPING DESIGNER AND CONTEMPLATES PIPING VISUAL INSPECTION, FLANGES, VALVES, AND INSTRUMENTS CONNECTIONS. THE LOGICAL SYSTEM VERIFICATION AND ALSO ELETRIC SYSTEM ARE NOT INCLUDED.

NOTES:
1. LIQUID LEVELS MEASURED FROM BOTTOM SEAM.
2. DELETED.
3. DEAD LEG
4. FOR MORE DETAILS CHECK 5004-ODS20-9020-0023.

CONFIDENTIAL
PROPRIETARY INFORMATION

13	HGF	AS BUILT/REVISED AS NOTED	10/05/10	MH	CCP
17	RSN	REVISED ACCORDING MOC 421	12/01/17	TL/VL	TL/VL
16	RSN	REVISED ACCORDING MOC 698	24/03/16	PL	PL
15	RSN	REVISED ACCORDING MOC 875	07/10/15	VA	VA
14	MSA	AS BUILT & REMOVED CLOUDS	05/12/12	MSA	LD/RD
NO.	BY	REVISION DESCRIPTION	DATE	CHK'D.	APPV'D.

MODEC INTERNATIONAL LLC CONFIDENTIAL AGREEMENT

CLIENT:
ENTERPRISE OIL
Bijupira & Salema

DRAWN BY: CH
DWG DATE:
DWG SCALE: NONE
AT D SIZE
SHEET:

MODEC INTERNATIONAL LLC

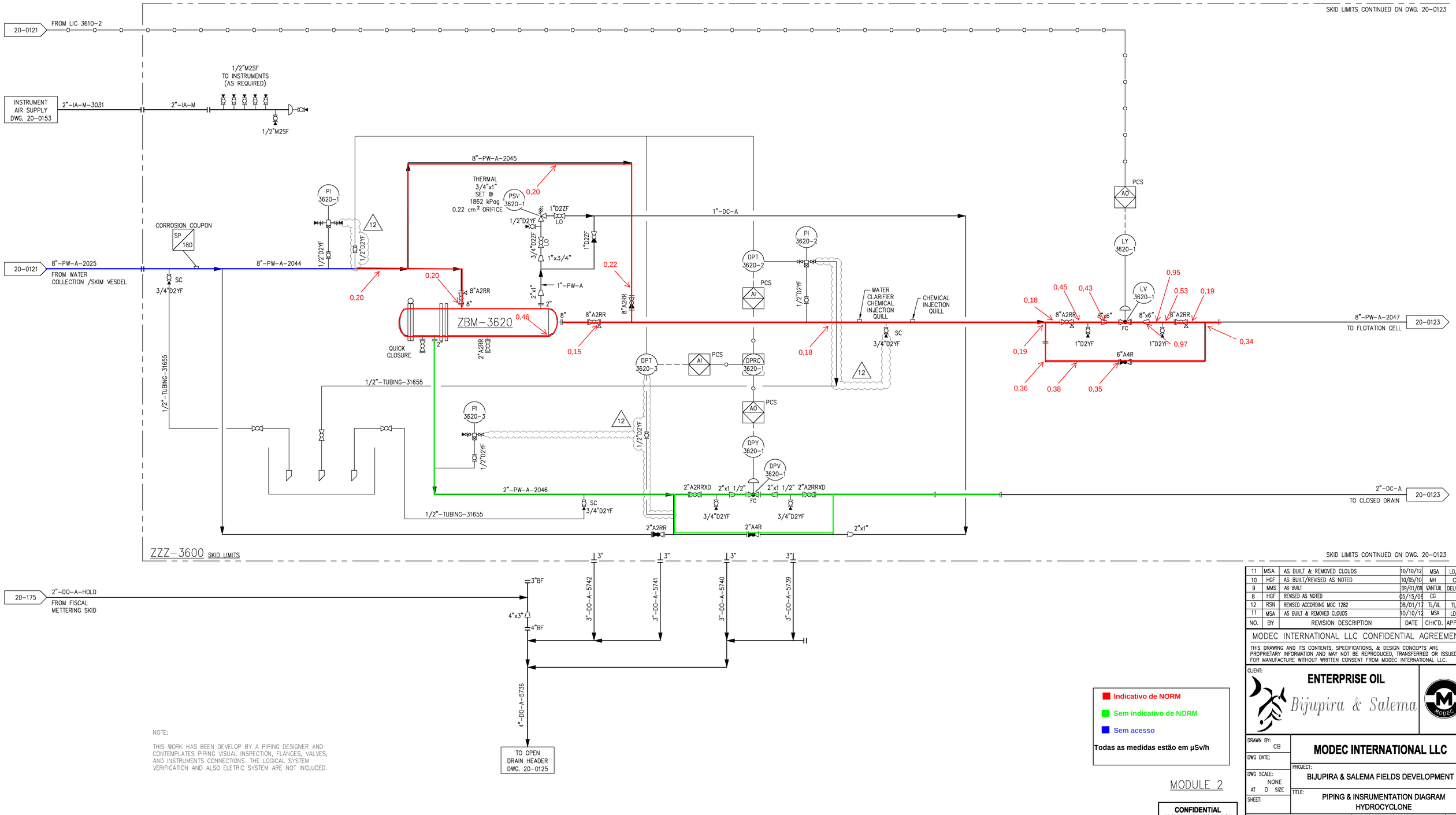
PROJECT:
BIJUPIRA & SALEMA FIELDS DEVELOPMENT

TITLE:
PIPING & INSTRUMENTATION DIAGRAM
WATER COLLECTION / SKIM VESSEL

CAD FILE: 01-20-0121
DWG NO: **1058-AE-20-90-20-0121**
REV: **17**

ZZZ-3600
PRODUCED WATER TREATING SKID

ZBM-3620
HYDROCYCLONE
SIZE: 762 mm (30") O.D. x 1830 mm (6') OAL
DESIGN: 1862 kPag (270 psig) @ 60°C (140°F)
OPERATING: 952 kPag (138 psig) @ 41°C (105°F)
CAPACITY: 345m³/hr (WATER) (52000 bpd)



NOTE:

THIS WORK HAS BEEN DEVELOP BY A PIPING DESIGNER AND CONTEMPLATES PIPING VISUAL INSPECTION, FLANGES, VALVES, AND INSTRUMENTS CONNECTIONS. THE LOGICAL SYSTEM VERIFICATION AND ALSO ELETRIC SYSTEM ARE NOT INCLUDED.

- Indicativo de NORM
- Sem indicativo de NORM
- Sem acesso

Todas as medidas estão em µSv/h

MODULE 2

CONFIDENTIAL
PROPRIETARY INFORMATION

NO.	BY	REVISION DESCRIPTION	DATE	CHK'D.	APPV'D.
11	MSA	AS BUILT & REMOVED CLOUDS	10/10/12	MSA	LD/RD
10	HGF	AS BUILT/REVISED AS NOTED	10/05/10	MH	CCP
9	MMS	AS BUILT	09/01/09	VANTUIL	DEUZIMAR
8	HGF	REVISED AS NOTED	05/15/08	CG	
12	RSN	REVISED ACCORDING MOC 1282	08/01/17	TL/VL	TL/VL
11	MSA	AS BUILT & REMOVED CLOUDS	10/10/12	MSA	LD/RD

CLIENT: ENTERPRISE OIL
Bijupira & Salema

DRAWN BY: CB
DWG DATE:
DWG SCALE: NONE
AT D SIZE
SHEET:

MODEC INTERNATIONAL LLC

PROJECT: BIJUPIRA & SALEMA FIELDS DEVELOPMENT

TITLE: PIPING & INSRUMENTATION DIAGRAM HYDROCYCLONE

CAD FILE: 01-20-0122
DWG NO: 1058-AE20-9020-0122
REV: 12

HBG-3650

PRODUCED WATER COOLER

DESIGN: HOT 1034 kPag (150 psig) @ 80°C (175°F)
COLD 1034 kPag (150 psig) @ 80°C (175°F)
OPERATING: HOT 83 kPag (12 psig) @ 52°C (125°F)
COLD 690 kPag (100 psig) @ 38°C (100°F)
DUTY: 4900 kW (16.7 MMBtu/h)

MBM-3630

FLOTATION CELL

SIZE: 3353 mm (11'-0") OD x 2590 mm (8'-6") T/T
DESIGN: 690 kPag (100 psig) @ 66°C (150°F)
OPERATING: 69 kPag (10 psig) @ 50°C (122°F)
CAPACITY: 345m³/h (52,000 bpd)

PBA-3635A/B

FLOTATION CELL PUMPS

CAPACITY: 114 m³/h (500 gpm) @ ΔP= 345 kPa (50 psi)
DRIVER: 22 kW (20 hp)
2 x 100%

20-0109 2"-PG-A-1220 TO 1st STAGE FLASH GAS COMPRESDOR

PIPERACK 0123 P-364 MODULE 2

SKID LIMITS CONTINUED ON DWG. 20-0122

4"BLIND

SET @ 70 kPag PCV 3630-1

SET @ 56 kPag PCV 3630-2

PT 3630-1

PT XXXX-X

1"-PG-A

2"-UG-A-3203 → UTILITY GAS SUPPLY DWG. 20-0142

ESD AI PI 3630-1 PAHH PALL

ZIC 3630-1 ZIO 3630-1 DI ESD

ZSC 3630-1 ZSO 3630-1

SDY 3630-1 SDV 3630-2 DO ESD IAS

30" MW

14" INSPECTION

MBM-3630

LIQUID LEVELS:

	OIL	WATER
LAHH		3100 mm
LAH	2390 mm	2850 mm
NLL		2540 mm
LAL	2082 mm	1930 mm
LALL		1016 mm

NOTE 2

LG 3630-1 LG 3630-2 LI 3630-3 LT 3630-1 LT 3630-2 LT 3630-3

LIC 3630-1 LAH LAL

LIC 3630-3 LAHH LALL

LI 3630-2 LAH LAL

LCV 3630-2

PI 3630-2

PCS AI LT 3630-1

BLEED RING

SAMPLE POINT

NOTE 04

FROM IP SEPARATOR BF 3"-DC-A-5025

20-0122 8"-PW-A-2047 WATER FROM HYDROCYCLONE

20-0122 2"-DC-A HYDROCYCLONE REJECT OIL

SKID LIMITS CONTINUED ON DWG. 20-0122

0,83 0,18 0,11 0,38 0,33 0,44 0,19 0,38 0,19 0,12 0,16 0,21 0,30 0,35 0,43 0,61 0,56 0,25 1,11 1,15 0,39 0,24 0,39 1,26 0,21 0,59 1,04 0,23 0,16 0,13 0,14 0,43 0,36 0,46 0,17 0,21

HBG-3650

PSV 3650-1 SET @ 1034 kPag

SP 27

TV 3650-1 TY 3650-1 TIC 3650-1 TT 3650-1 FT 3650-1 FE 3650-1 FQI 1160-1 E-HOUSE

TAH

AO PCS AI

XV 3630-1 XV 3630-2 XVY 3630-1 XVY 3630-2 XVY 3630-3

AAH AE 3630-1 SET @ 20 PPM

LY 3630-1 LV 3630-1

SP 81 SP 10 SP 81

PSV 3630-1 SET @ 690 kPag 69.4 CM ORIFICE

AE 3630-1 AAH

SAMPLE POINT

TO DECK

TO OFF-SPEC TANK

0123 P-204 SHIPSIDE MODULE 2

0123 P-203 SHIPSIDE MODULE 2

WATER OVERBOARD

COOLING WATER RETURN DWG. 20-0143

COOLING WATER SUPPLY DWG. 20-0143

20-0109 3"-PL-A-1189 FROM ELECTROSTATIC TREATERS

20-0107 2"-PL-A-1188 FROM IP SEPARATOR

TO CLOSED DRAIN HEADER DWG. 20-0124

SAMPLE POINT

EDUCTOR GAS SUPPLY

3/8" SS TUBING

PSV 3/8"x3/8" SET @ 1500 kPag

W.C. DRUM 02VF112 SKID ON MODULE 2

PBA 3635A-1 PBA 3635A-2 PBA 3635B-1 PBA 3635B-2

RI 3635A-1 RI 3635A-2 RI 3635B-1 RI 3635B-2

SS 3635A-1 SS 3635A-2 SS 3635B-1 SS 3635B-2

START STOP

MCC

START UP STRAINER

PBA-3635A PBA-3635B

NOTES

1. ADD HAND JACKS.
2. ALL LEVELS FROM BOTTOM TANGENT.
3. DELETED
4. TO BE FLANGED AND ABANDON IN PLACE.
5. AS BUILT PER MOC 663.
6. SPIRAL GASKETS OF POLITETRAFLUETILENO, (TEFLON-PTFE) EXPANDED, FR 150#, 1/8", (2, 3, 4)
7. FOR MORE DETAILS CHECK 5004-ODS20-9020-0020.
8. VACCUM BREAKER.
9. ENSURE THE 10"A2RF VALVE, IN THE OUTLET OF HBG-3650, IS OPENED WHENEVER THE BYPASS MANUAL VALVE 6"A2RR IS LOCKED-OPEN.

NOTE:

THIS WORK HAS BEEN DEVELOPED BY A PIPING DESIGNER AND CONTEMPLATES PIPING VISUAL INSPECTION, FLANGES, VALVES, AND INSTRUMENTS CONNECTIONS. THE LOGICAL SYSTEM VERIFICATION AND ALSO ELETRIC SYSTEM ARE NOT INCLUDED.

MODULE 2

CONFIDENTIAL PROPRIETARY INFORMATION

- Indicativo de NORM
- Sem indicativo de NORM
- Sem acesso

Todas as medidas estão em µSv/h

NO.	BY	REVISION DESCRIPTION	DATE	CHK'D.	APPV'D.
19	RSN	REVISED ACCORDING MOC 1223	27/06/16	PL	PL
18	RSN	REVISED ACCORDING MOC 1067	11/02/16	TL	TL
17	RSN	REVISED ACCORDING MOC 878	07/10/15	VA	VA
21	RSN	REVISED ACCORDING MOC 1382	11/03/17	PL	PL
20	RSN	REVISED ACCORDING MOC 1058 & 464	16/01/17	RA	TL/VL

CLIENT: ENTERPRISE OIL — Bijupira & Salema

DRAWN BY: DC

DWG DATE:

DWG SCALE: NONE AT D SIZE

SHEET:

MODEC INTERNATIONAL LLC

PROJECT: BIJUPIRA & SALEMA FIELDS DEVELOPMENT

TITLE: PIPING & INSTRUMENTATION DIAGRAM FLOTATION CELL

CAD FILE: 01-20-0123

DWG NO: 1058-AE-20-90-20-0123

REV: 21

ABH-3410

CLOSED DRAIN SUMP TANK
SIZE: 1220 mm (48") OD x 3050 mm (10') S/S
DESIGN: 676 kPag (98 psig) @ -45°C/66°C (-49°F)/(150°F)
OPERATING: 28 kPag BARG (4 psig) @ -35°C/38°C (-31°F/100°F)

PBE-3415A/B

CLOSED DRAIN SUMP PUMPS
CAPACITY: 28.4 m^3/h (125 gpm) GPM @△ P = 1034 kPag (150 psig)
DRIVER: 30 kW (40 hp)

FROM SALEMA INLET HEATER DWG. 20-0105
FROM TESTE INLET HEATER DWG. 20-0103
FROM BIJUPIRA INLET HEATER DWG. 20-0104
FROM SALES OIL COOLER DWG. 20-0106
FROM CRUDE/ CRUDE EXCHANGER "B" DWG. 20-0106
FROM IP SEPARATOR DWG. 20-0107
FROM CRUDE/ CRUDE EXCHANGER "A" DWG. 20-0106
FROM WATER COLLECTION SKIM VESSEL DWG. 20-0121
FROM CRUDE HEATER DWG. 20-0106
FROM WATER COLLECTION SKIM VESSEL DWG. 20-0121
FROM PSV-1210-1 DWG. 20-0147
FROM FLOTATION CELL DWG. 20-0123
FROM FLOTATION CELL DWG. 20-0123
FROM PBA-1145A/B/C DWG. 20-0108
FROM MBK-1140B DWG. 20-0109
FROM MBK-1140A DWG. 20-0108
FROM PSV-3515-1 DWG. 20-0148
FROM SALEMA SEPARATOR DWG. 20-0105
FROM TEST SEPARATOR DWG. 20-0103
FROM BIJUPIRA SEPARATOR DWG. 20-0104
FROM FISCAL METERING SKID DWG. 20-0175

6"-DC-D-5051 (NOTA 4)
CLOSED DRAIN HEADER
6"-DC-A-5061
TO OFF-SPEC TANK
SHIPSIDE | PIPERACK

FROM MOD. 7A H.P. FLARE LINE DWG. 20-0114
FROM MODULE 7A DWG. 20-0112
FROM MODULE 7A DWG. 20-0163
FROM MOD. 7B H.P. FLARE LINE DWG. 20-0114
FROM MODULE 7B DWG. 20-0112
FROM MODULE 7B DWG. 20-0163
FROM MOD. 7C H.P. FLARE LINE DWG. 20-0114
FROM MODULE 7C DWG. 20-0112
FROM MODULE 7C DWG. 20-0163
FROM MOD. 7D H.P. FLARE LINE DWG. 20-0114
FROM MODULE 7D DWG. 20-0112
FROM MODULE 7D DWG. 20-0163

FROM FGC "A" & "B" DWG. 20-0110
SCRUBBER DRAINS
FROM FLASH GAS COMPRESSOR "B" DWG. 20-0162
FROM FLASH GAS COMP. "A" DWG. 20-0162
FROM VAPOR RECOVERY UNIT DWG. 20-0117
FROM FUEL GAS SCRUBBER DWG. 20-0141
FROM GLYCOL REGENERATION DWG. 20-0116
FROM FGC "A"&"B" FLARE HDR DRAIN DWG. 20-0111

20-0120 2"-FL-A-4116 EQUALIZATION TO LP FLARE SCRUBBER
20-0120 4"-FL-A-4128 TO/FROM L.P. FLARE SCRUBBER
20-0120 3"-DC-A-5044 FROM L.P. FLARE SCRUBBER
20-0121 3"-PW-A-2035 FROM WATER COLLECTION / SKIM VESSEL
20-0121 4"-PL-A-1154 TO WATER COLLECTION / SKIM VESSEL
20-0106 4"-PL-A-1164 TO CRUDE - CRUDE EXCHANGER

FROM HP FLARE SCRUBBER DWG. 20-0119
FROM GAS FILTER SEPARATOR DWG. 20-0115

ABH-3410
LIQUID LEVELS:
LAHH - 1040
LAH - 890
NLL - 600
LAL - 300
LALL - 150
VORTEX BREAKER

PBE-3415A START UP STRAINER
PBE-3415B START UP STRAINER
MODULE 10

LAH-START 2nd PUMP
PUMP ON NOTE 1
PUMP OFF
LAL-STOP BOTH PUMPS

Indicativo de NORM
Sem indicativo de NORM
Sem acesso
Todas as medidas estão em µSv/h

NOTE:

THIS WORK HAS BEEN DEVELOPED BY A PIPING DESIGNER AND CONTEMPLATES PIPING VISUAL INSPECTION, FLANGES, VALVES, AND INSTRUMENTS CONNECTIONS. THE LOGICAL SYSTEM VERIFICATION AND ALSO ELETRIC SYSTEM ARE NOT INCLUDED.

NOTES:
1. LAH STARTS 2ND PUMP, LAL STOPS BOTH PUMPS.
2. DELETED
3. DEAD LEG.
4. PIPING AND FITTINGS CHANGED TO SPEL "D".

NO.	BY	REVISION DESCRIPTION	DATE	CHK'D.	APPV'D.
14	MSA	AS BUILT & REMOVED CLOUDS	10/10/12	MSA	LD/RD
13	HGF	AS BUILT/REVISED AS NOTED	10/05/10	MH	CCP
12	JP	AS BUILT	08/04/09	MMS	DEUZMAR
16	RDX	AS BUILT	20/02/19	AFD	DFG
15	RSN	REVISED ACCORDING MOC 1118	03/03/16	PL	PL

CLIENT: ENTERPRISE OIL — Bijupira & Salema

DRAWN BY: CB
DWG DATE:
DWG SCALE: NONE
AT D SIZE
SHEET:

MODEC INTERNATIONAL LLC

PROJECT: BIJUPIRA & SALEMA FIELDS DEVELOPMENT

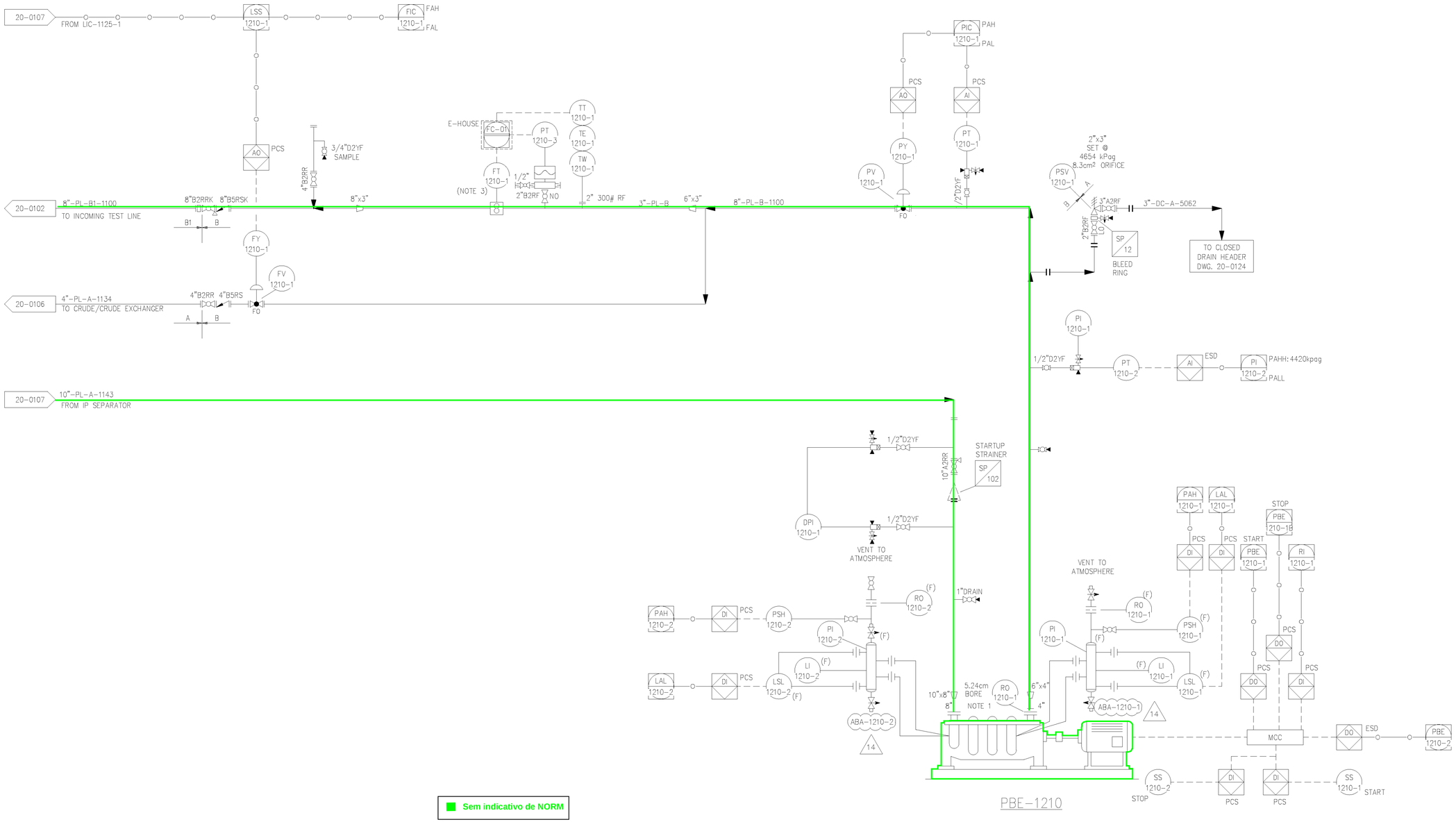
TITLE: PIPING & INSTRUMENTATION DIAGRAM CLOSED DRAIN SYSTEM

CONFIDENTIAL
PROPRIETARY INFORMATION

CAD FILE: 01-20-0124
DWG NO: 1058-AE-20-90-20-0124
REV: 16

PBE-1210

FLOWLINE CIRCULATION PUMP
CAPACITY: 182 m^3/h (800 gpm) @△P=4140 kPa (600 psi)
DRIVER: 375 kW (500 hp)
800 gpm 4554 OPERATING



PBE-1210

Sem indicativo de NORM

NOTE:

THIS WORK HAS BEEN DEVELOPED BY A PIPING DESIGNER AND CONTEMPLATES PIPING VISUAL INSPECTION, FLANGES, VALVES, AND INSTRUMENTS CONNECTIONS. THE LOGICAL SYSTEM VERIFICATION AND ALSO ELETRIC SYSTEM ARE NOT INCLUDED.

NOTES:
1. PUMP FLANGES ARE 900# ANSI.
2. DELETED.
3. FOR MORE DETAILS CHECK 5004-0DS20-9020-0008.

MODULE 2

CONFIDENTIAL
PROPRIETARY INFORMATION

NO.	BY	REVISION DESCRIPTION	DATE	CHK'D.	APPV'D.
12	MSA	AS-BUILT IN ACCORDANCE WITH SHUTDOWN	16/01/14	MSA	GBT
11	MSA	AS BUILT & REMOVED CLOUDS	05/12/12	MSA	LD/RD
10	HGF	AS BUILT/REVISED AS NOTED	10/05/10	MH	CCP
14	RSN	TAGS ADDED TO EQUIPMENT AS PER AREA	19/04/17	TC	TC
13	RSN	REVISED ACCORDING MOC 876	07/10/15	VA	VA

CLIENT: ENTERPRISE OIL
Bijupira & Salema

DRAWN BY: DB
DWG DATE:
DWG SCALE: NONE
AT D SIZE
SHEET:

MODEC INTERNATIONAL LLC

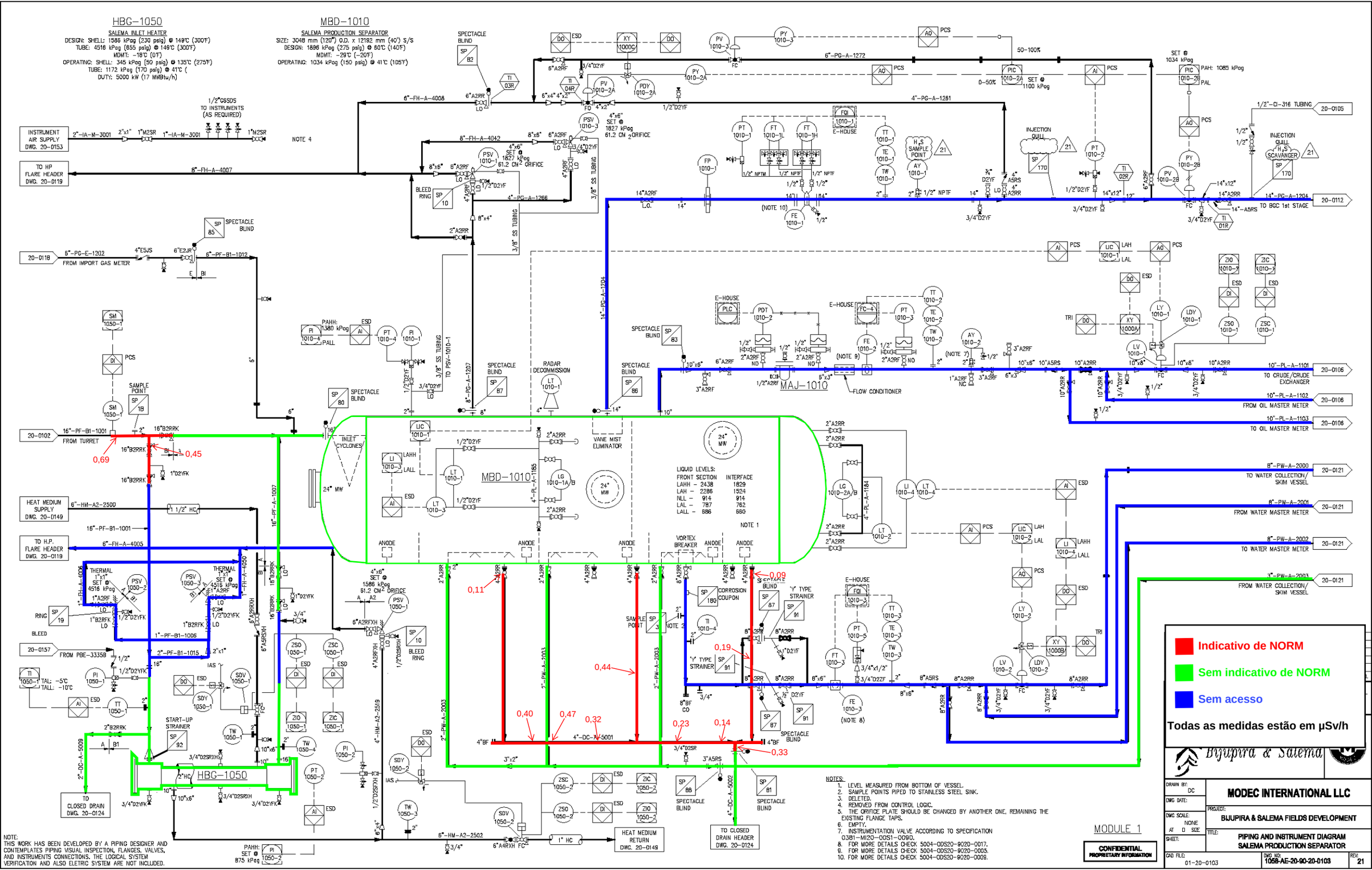
PROJECT: BIJUPIRA & SALEMA FIELDS DEVELOPMENT

TITLE: PIPING & INSTRUMENTATION DIAGRAM FLOWLINE CIRCULATION PUMP

CAD FILE: 01-20-0147

DWG NO: 1058-AE-20-90-20-0147

REV: 14


HBG-1050
SALEMA INLET HEATER
DESIGN: SHELL: 1586 kPag (230 psig) @ 149°C (300°F)
TUBE: 4516 kPag (655 psig) @ 149°C (300°F)
MDMT: -18°C (0°F)
OPERATING: SHELL: 345 kPag (50 psig) @ 135°C (275°F)
TUBE: 1172 kPag (170 psig) @ 41°C (
DUTY: 5000 kW (17 MMBtu/h)
MBD-1010
SALEMA PRODUCTION SEPARATOR
SIZE: 3048 mm (120") O.D. x 12192 mm (40') S/S
DESIGN: 1896 kPag (275 psig) @ 60°C (140°F)
MDMT: -29°C (-20°F)
OPERATING: 1034 kPag (150 psig) @ 41°C (105°F)
INSTRUMENT AIR SUPPLY DWG. 20-0153
TO HP FLARE HEADER DWG. 20-0119
NOTE 4
20-0118
FROM IMPORT GAS METER
20-0102
FROM TURRET
HEAT MEDIUM SUPPLY DWG. 20-0149
TO H.P. FLARE HEADER DWG. 20-0119
20-0157
FROM PBE-33358
TO CLOSED DRAIN DWG. 20-0124
HEAT MEDIUM RETURN DWG. 20-0149
TO CLOSED DRAIN HEADER DWG. 20-0124
INLET CYCLONES
VANE MIST ELIMINATOR
VORTEX BREAKER
ANODE
LIQUID LEVELS:
FRONT SECTION INTERFACE
LAHH - 2438 1829
LAH - 2286 1524
NLL - 914 914
LAL - 787 762
LALL - 686 660
NOTE 1
MAJ-1010
FLOW CONDITIONER
E-HOUSE
RADAR DECOMMISSION
SAMPLE POINT
CORROSION COUPON
"Y" TYPE STRAINER
START-UP STRAINER
INJECTION GULL
H2S SCAVENGER
20-0105
20-0112
TO BGC 1st STAGE
20-0106
TO CRUDE/CRUDE EXCHANGER
FROM OIL MASTER METER
TO OIL MASTER METER
20-0121
TO WATER COLLECTION/ SKIM VESSEL
FROM WATER MASTER METER
TO WATER MASTER METER
FROM WATER COLLECTION/ SKIM VESSEL
0,69
0,45
0,11
0,09
0,19
0,44
0,40
0,47
0,32
0,23
0,14
0,33
Indicativo de NORM
Sem indicativo de NORM
Sem acesso
Todas as medidas estão em µSv/h
NOTES:
1. LEVEL MEASURED FROM BOTTOM OF VESSEL.
2. SAMPLE POINTS PIPED TO STAINLESS STEEL SINK.
3. DELETED.
4. REMOVED FROM CONTROL LOGIC.
5. THE ORIFICE PLATE SHOULD BE CHANGED BY ANOTHER ONE, REMAINING THE EXISTING FLANGE TAPS.
6. EMPTY.
7. INSTRUMENTATION VALVE ACCORDING TO SPECIFICATION 0381-MI20-00S1-0090.
8. FOR MORE DETAILS CHECK 5004-ODS20-9020-0017.
9. FOR MORE DETAILS CHECK 5004-ODS20-9020-0005.
10. FOR MORE DETAILS CHECK 5004-ODS20-9020-0008.
NOTE:
THIS WORK HAS BEEN DEVELOPED BY A PIPING DESIGNER AND CONTEMPLATES PIPING VISUAL INSPECTION, FLANGES, VALVES, AND INSTRUMENTS CONNECTIONS. THE LOGICAL SYSTEM VERIFICATION AND ALSO ELETRIC SYSTEM ARE NOT INCLUDED.
MODULE 1
CONFIDENTIAL
PROPRIETARY INFORMATION
Byupira & Salema
DRAWN BY: DC
DWG DATE:
DWG SCALE: NONE
AT SIZE
SHEET:
CAD FILE: 01-20-0103
MODEC INTERNATIONAL LLC
PROJECT: BIJUPIRA & SALEMA FIELDS DEVELOPMENT
TITLE: PIPING AND INSTRUMENT DIAGRAM SALEMA PRODUCTION SEPARATOR
DWG NO: 1058-AE-20-90-20-0103
REV: 21

HBG–1055

BIJUPIRA INLET HEATER
DESIGN: SHELL: 1586 kPag (230 psig) @ 149°C (300°F)
TUBE: 4516 kPag (655 psig) @ 149°C (300°F)
MDMT: –18°C (0°F)
OPERATING: SHELL: 345 kPag (50 psig) @ 135°C (275°F)
TUBE: 1172 kPag (170 psig) @ 41°C (105°F)
DUTY: 5000 kW (17 MMBtu/h)

MBD–1015

BIJUPIRA PRODUCTION SEPARATOR
SIZE: 3048 mm (120") O.D. x 12192 mm (40') S/S
DESIGN: 1896 kPag (275 psig) @ 60°C (140°F)
MDMT: –29°C (–20°F)
OPERATING: 1034 kPag (150 psig) @ 41°C (105°F)

TO HP FLARE HEADER DWG. 20-0119

6"–PG–E–1205 FROM IMPORT GAS METER 20-0118

8"–FH–A–4010

6"–FH–A–4009

SPECTACLE BLIND SP 82

TI 07R

6"A2RR LO

MOC 399

DO ESD

XY 1000C

DO TRI

PV 1015–2A

TI 08R

PDY 1015–2A

PY 1015–2A

3/4"D2YF

4"x2"

4"x6" FO SET @ 1827 kPag 61.2 CM² ORIFICE

PSV 1015–3

PY 1015–3

AO PCS

PV 1015–3

6"A2RF

FC

3/4"D2YF

6"–PG–A–1273

SET @ 1100 kPag

0–50% PIC 1015–2A 50–100%

4"–PG–A–1263

AI PCS

SET @ 1034 kPag

PIC 1015–2B PAH: 1085 kPag PAL

1/2"–CI–316 TUBING 20-0201

8"–FH–A–4044

MOC 399

8"x6"

4"x6" SET @ 1827 kPag 61.2 CM² ORIFICE

6"A2RF LO

3/4"D2YF

PSV 1015–1

3/4"D2YF

8"x6"

6"A2RF LO

4"A2RF LO

4"–PG–A–1261

3/8" S.S. TUBING

1/2"D2YF

BLEED RING SP 10

4"A2RF LO

2"A2RR

PT 1015–1

FT 1015–1L

FT 1015–1

FQI 1010–1 E–HOUSE

TT 1015–1

TE 1015–1

TW 1015–1

H₂S SAMPLE POINT

AY 1015–1

16

DBB MANIFOLD WITH SAMPLE PROBE

FP 1015–1

1/2" NPTM

1/2" NPTF

1/2" NPTF

1/2" NPTF

1/2"

1/2"

14"

(NOTE 7)

FE 1015–1

1/2"

14"A2RF L.O.

14"

2"

2"

14"

3/4" D2YF

PT 1015–2

3/4" D2YF

1/2"D2YF

4" A5RS

4" A2RR

INJECTION QUILL H₂S SCAVENGER SP 170A

16

1/2"

1/2"

6"A2RF

INJECTION QUILL SP 170

PV 1015–2B

PY 1015–2B

TI 05R

14"x12"

14"A2RR

14"–PG–A–1206 TO BCC 1st STAGE 20-0112

3/4" D2YF

14"A5RS

FC

3/4"D2YF

14"x12"

12"

3/4"D2YF

16

AI PCS

LIC 1015–1 LAH LAL

AO PCS

SPECTACLE BLIND SP 85

E–HOUSE PLC

FDT 1015–2

E–HOUSE FC–4

PT 1015–3

TT 1015–2

TE 1015–2

TW 1015–2

AY 1015–2

(NOTE 5)

LDY 1015–1

LY 1015–1

LV 1015–1

DO ESD

XY 1000A

DO TRI

6"–PF–B1–1013

E

B1

6"E2JR LC

SM 1055–1

DI

SAMPLE POINT SP 1B

PAHH: 1380 kPag PALL

AI ESD

PT 1015–4

PI 1015–1

3/8" S.S. TUBING TO PSV–1015–1

8"–PG–A–1262

8"x4"

SPECTACLE BLIND SP 87

3/4" D2YF

14"–PG–A–1205

RADAR DECOMMISSIOM

LT 1015–1

SPECTACLE BLIND SP 83

SPECTACLE BLIND SP 86

10"x6"

6"A2RF

3"A2RF

1/2"

2"A2RF NO

1/2"

2"A2RF NO

1/2"A2RF MAJ–1015

6"x3"

(NOTE 6)

FLOW CONDITIONER

1"A2RF NC

3"A2RF

10"x6"

10"A5RS

10"A2RR

10"x8"

10"x8"

10"A2RR

10"–PL–A–1104 TO CRUDE/ CRUDE EXCHANGER 20-0106

10"A2RR

3/4"D2YF

3/4"D2YF

10"–PL–A–1105 FROM OIL MASTER METER 20-0106

10"–PL–A–1106 TO OIL MASTER METER

0,58

0,47

0,51

0,43

0,42

0,41

0,62

0,14

0,36

0,84

0,42

0,59

0,20

0,25

0,40

0,54

0,43

0,21

0,46

0,19

0,26

0,26

0,10

20-0102 16"–PF–B1–1000 FROM TURRET

16"B2RRK

BI A

1"D2YFK

HEAT MEDIUM SUPPLY DWG. 20-0149

6"–HM–A2–2503

1 1/2" HC

16"–PF–A–1009

TO H.P. FLARE HEADER DWG. 20-0119

6"–FH–A–4011

1"–FH–A–4051

1"–FH–A–4012

THERMAL 1"x1" SET @ 4516 kPag

PSV 1055–2

PSV 1055–3

THERMAL 1"x1" SET @ 4516 kPag

1"A2RFK LO

1"B2RFK LO

1/2"D2YFK LO

BLEED RING SP 19

6"BF

1"–PF–B1–1008

2"x1"

2"–PF–B1–1016

20-0102 FROM PBE–3335A

3/4"

PI 1055–1

1/2"D2YFK

DO ESD

TI 1055–1 TAL: –5°C TALL: –10°C

AI ESD

TT 1055–1

2"

SDY 1055–1

SDV 1055–1

IAS

START–UP STRAINER SP 92

TW 1055–1

2"

3/4"D2YF

1/2" D2YF

10"x6"

TW 1055–4

TO CLOSED DRAIN DWG. 20-0124

2"–DC–A–5010

2"B2RRK

A B1

16"

2"HC HBG–1055

3/4"D2YFK

10"x6"

3/4"D2SRXH

3/4"D2YFK

SP 80 SPECTACLE BLIND

16"

INLET CYLINDERS

24" MW

VANE MIST ELIMINATOR

24" MW

LIC 1015–1

1/2"D2YF

LAHH LI 1015–3 LALL

AI ESD

LT 1015–1A

LT 1015–1B

1/2"D2YF

4"–PL–A–1174

LG 1015–A/B

2"A2RR

2"A2RR

LIQUID LEVELS:

FRONT SECTION	INTERFACE
LAHH – 2438	1829
LAH – 2286	1524
NLL – 914	914
LAL – 787	762
LALL – 686	660

NOTE 1

MBD–1015

ANODE ANODE ANODE VORTEX BREAKER ANODE ANODE

2"A2RR 2"A2RR 2"A2RR 4"A2RR 2"A2RR 4"A2RR 2"A2RR 8" A2RR 4" A2RR

2"–PW–A–2007

2"–PW–A–2007

2"–PW–A–2007

4"–HM–A2–2533

4"–DC–A–5004

4" A2RR

4" A2RR

4"BF

3"x2"

8"BF CO

CORROSION COUPON SP 180

TI 1015–4

SPECTACLE BLIND SP 87

SPECTACLE BLIND SP 87

'Y' TYPE STRAINER SP 91

'Y' TYPE STRAINER SP 91

SAMPLE POINT SP 3

2" NOTE 2

8"A2RR 8"A2RR 8"x6" 3/4"x1/2" 2" 8"A5RS BF2" 8"A2RR

½" D2YF

4"BF

SPECTACLE BLIND SP 87

FE 1015–3

TT 1015–3

TE 1015–3

TW 1015–3

PT 1015–5

FT 1015–3

LV 1015–2

LDY 1015–2

LY 1015–2

AO PCS

LIC 1015–2 LAH LAL

LI 1015–4 LAHH LALL

AI ESD

DO ESD

XY 1000B

DO TRI

8"A2RR

8"–PW–A–2004 TO WATER COLLECTION/ SKIM VESDEL 20-0121

8"–PW–A–2005 FROM WATER MASTER METER 20-0121

8"–PW–A–2006 TO WATER MASTER METER 20-0121

3"–PW–A–2007 FROM WATER COLLECTION/ SKIM VESSEL 20-0121

8"A2RR 8"A2RR 1"D2YF 1"D2YF

FC

3/4"D2YF

4"–DC–A–5005

TO CLOSED DRAIN HEADER DWG. 20-0124

3"

3/4"D2YF

SPECTACLE BLIND SP 88

Y2" D2YF

3"A5RS

SP 8"

SDV 1055–2

IAS

SDY 1055–2

ESD DO

ZSC 1055–2 DI ESD ZIC 1055–2

ZSO 1055–2 DI ESD ZIO 1055–2

TW 1055–3

2"

6"–HM–A2–2504

6"A4RXH FC

1"HC

HEAT MEDIUM RETURN DWG. 20-0149

PAHH: 875 kPag PI 1055–2

6"–PF–A–1010

6"A5RSXH

ZSO 1055–1 ZSC 1055–1 ESD

DI DI

ZIO 1055–1 ZIC 1055–1

PI 1055–2

PT 1055–2

AI ESD

6"A2RFXH LO

4"A2RFXH LO

1/2"D2SRXH

6"A2RFXH LO

SP 10 BLEED RING

PSV 1055–1 4"x6" SET @ 1586 kPag 61.2 CM² ORIFICE

16"B2RRK LO

1"D2YFK

A A2

B1

0,36

0,19

NOTES:

1. LEVEL MEASURED FROM BOTTOM OF VESSEL.
2. SAMPLE POINTS PIPED TO STAINLESS STEEL SINK.
3. DELETED.
4. DELETED.
5. INSTRUMENTATION VALVE ACCORDING TO SPECIFICATION 0381–MI20–0051–0090.
6. FOR MORE DETAILS CHECK 5004–0DS20–9020–0006.
7. FOR MORE DETAILS CHECK 5004–0DS20–9020–0010.
8. FOR MORE DETAILS CHECK 5004–0DS20–9020–0018.

16

NOTE:

THIS WORK HAS BEEN DEVELOPED BY A PIPING DESIGNER AND CONTEMPLATES PIPING VISUAL INSPECTION, FLANGES, VALVES, AND INSTRUMENTS CONNECTIONS. THE LOGICAL SYSTEM VERIFICATION AND ALSO ELETRIC SYSTEM ARE NOT INCLUDED.

MODULE 1

CONFIDENTIAL
PROPRIETARY INFORMATION

Indicativo de NORM
Sem indicativo de NORM
Sem acesso
Todas as medidas estão em µSv/h

NO.	BY	REVISION DESCRIPTION	DATE	CHK'D.	APPV'D.
12	MSA	AS	09/10/12	MSA	LD/RD
16	RSN	RE	14/03/17	PL	PL
15	RSN	RE	09/01/17	TL/VL	TL/VL
14	RSN	RE	29/08/16	PW	PW
13	RSN	RE	07/10/15	VA/TL	VA/TL

CLIENT: ENTERPRISE OIL — Bijupira & Salema

MODEC

DRAWN BY: DC	MODEC INTERNATIONAL LLC
DWG DATE:	PROJECT: BIJUPIRA & SALEMA FIELDS DEVELOPMENT
DWG SCALE: NONE AT D SIZE	TITLE: PIPING & INSTRUMENTATION DIAGRAM BIJUPIRA PRODUCTION SEPARATOR
SHEET:	
CAD FILE: 01–20–0104	DWG NO: 1058-AE-20-90-20-0104 REV: 16

HBC–1060

TEST INLET HEATER

DESIGN: SHELL 1585 kPag (230 psig) @ 149°C (300°F)
TUBE 4516 kPag (655 psig) @ 149°C (300° F)
MDMT: –18°C (0°F)
OPERATING SHELL 345 kPag (50 psig) @ 135°C (275°F)
TUBE: 1172 kPag (170 psig) @ 41°C (105°F)
DUTY: 1937 kW (6.6 MMBtu/h)

MBD–1020

TEST PRODUCTION SEPARATOR

SIZE: 2286 mm (90") O.D. x 8890 mm (29') S/S
DESIGN: 1896 kPag (275 psig) @ 60°C (140°F)
MDMT: –29°C (–20°F)
OPERATING: 1034 kPag (150 psig) @ 41DC (105°F)

20–0173 (SEE NOTE 5) 3/8"–FH–Z–4057 FROM H2S ANALYZER

TO H.P. FLARE HEADER DWG. 20–0119

20–0118 6"–PG–E–1249 FROM IMPORT GAS METER

20–0102 10"–PF–B1–1002 FROM TURRET

20–0157 3/8" S.S. TUBING FROM PBE–3335C

HEAT MEDIUM SUPPLY DWG. 20–0149

HEAT MEDIUM RETURN DWG. 20–0149

TO CLOSED DRAIN DWG. 20–0124

TO CLOSED DRAIN HEADER DWG. 20–0124

4"–FH–A–4039 · 8"–FH–A–4046 · 8"–FH–A–4016 · 6"–FH–A–4014 · 4"–HM–A2–2506 · 10"–PF–B1–1002 · 10"–PF–A–1011 · 1"–FH–A–4052 · 1"–FH–A–4053 · 2"–PF–B1–1017 · 2"–PF–B1–1010 · 6"–PF–B1–1014 · 2"–DC–A–5011 · 4"–HM–A2–2534 · 6"–PG–A–1284 · 8"–PG–A–1209 · 4"–PG–A–1268 · 3/8" SS TUBING TO PSV–1020–1 · 3/8" S.S. TUBING · 2"–PW–A–2011 · 4"–DC–A–5007 · 4"–DC–A–5008 · 3"x2" · 4"–PL–A–1176 · 4"–PL–A–1177 · 3"–PG–A–1265 · 4"–PG–A–1274 · 3"–PG–A–1333 · 8"–PG–A–1209 · 6"–PG–A–1107 · 6"–PL–A–1108 · 6"–PL–A–1109 · 4"–PW–A · 4"–PW–A–2008 · 4"–PW–A–2009 · 4"–PW–A–2010 · 3"–PW–A–2011

HBG–1060 · MBD–1020 · MAJ–1020 · MODULE 1

INLET CYCLONES · VANE MIST ELIMINATOR · 24" MW · 61.2 CM ORIFICE · 1586 kPag SET @ 2 · 1827 kPag SET @ 61.2 CM² ORIFICE · 1034 kPag SET @ · 1100 kPag SET @ · 0–50% · 50–100% · PAH: 1085 kPag · PAHH: 1380 kPag · PAHH: 875 kPag · PAL · LAH · LAL · LAHH · LALL · ANODE · VORTEX BREAKER · FLOW CONDITIONER 19 PIPING · DBB MANIFOLD WITH SAMPLE PROBE · H₂S SAMPLE POINT · BLEED RING · INJECTION QUILL · H₂S SCAVANGER · SPECTACLE BLIND · 'Y' TYPE STRAINER · CORROSION COUPON · SAMPLE POINT · START–UP STRAINER · E–HOUSE · ISOLATED · TO H2S ANALYZER · TO BCC 1st STAGE · TO CRUDE/ CRUDE EXCHANGER · FROM OIL MASTER METER · TO OIL MASTER METER · TO WATER COLLECTION/ SKIM VESSEL · FROM WATER MASTER METER · TO WATER MASTER METER · FROM WATER COLLECTION/ SKIM VESSEL

LIQUID LEVELS:

FRONT SECTION	INTERFACE
LAHH –1829	1372
LAH – 1752	1143
NLL – 787	686
LAL – 686	584
LALL – 610	483

NOTE 1

NOTES:
1. LEVEL MEASURED FROM BOTTOM OF VESSEL.
2. SAMPLE POINTS PIPED TO STAINLESS STEEL SINK.
3. DELETED.
4. THE EXISTING BLIND FLANGE OF 2" TO BE REPLACED
5. 3/8" TUBING 316 SS 0,049 WALL SEAMLESS 4800 PSI RATED. SULFINER COATED.
6. INSTRUMENTATION VALVE ACCORDING TO SPECIFICATION 0.381–M/20–0051–0090.
7. FOR MORE DETAILS CHECK 5004–0DS20–9020–0007.
8. FOR MORE DETAILS CHECK 5004–0DS20–9020–0019.
9. FOR MORE DETAILS CHECK 5004–0DS20–9020–0011.
10. FOR MORE DETAILS CHECK 5004–0DS20–9020–0012.
11. THE PIPING DOWNSTREAM OF THE VALVES WERE CUT AND THE FLANGES WERE WELDED WITH 6" ROTATION IN THE OPPOSITE DIRECTION TO ALLOW THE ASSEMBLY OF THE VALVES. FOR MORE DETAILS CHECK MOC 1042.

Indicativo de NORM
Sem indicativo de NORM
Sem acesso
Todas as medidas estão em µSv/h

CONFIDENTIAL PROPRIETARY INFORMATION

NO.	BY	REVISION DESCRIPTION	DATE	CHK'D.	APPV'D.
21	RSN	REVISED ACCORDING MOC 1281	14/03/17	PL	PL
20	RSN	REVISED ACCORDING MOC 1070 & 1283	06/01/17	TL/VL	TL/VL
19	RSN	REV. ACCORDING MOC 1042 SD COO 327/309	20/07/16	HV	DE
18	RSN	REVISED ACCORDING MOC 874, 875 AND 876	06/10/15	VA	VA
17	RSN	AS BUILT – GAS SYSTEM MEASUREMENT	7/18/13	DRS	DRS

CLIENT: ENTERPRISE OIL — Bijupira & Salema

DRAWN BY: DC
DWG DATE:
DWG SCALE: NONE
AT D SIZE
SHEET:

MODEC INTERNATIONAL LLC

PROJECT: BIJUPIRA & SALEMA FIELDS DEVELOPMENT

TITLE: PIPING & INSTRUMENTATION DIAGRAM TEST PRODUCTION SEPARATOR

CAD FILE: 01–20–0105

DWG NO: 1058-AE-20-90-20-0105

REV: 21

HBG-1150 (OUT OF OPERATION)

SALES OIL COOLER
DESIGN: HOT 1035 kPag (150 psig) @ 93°C (200°F)
COLD 1035 kPag (150 psig) @ 93°C (200°F)
OPERATING: HOT 20 kPag (3 psig) @ 46°C (115°F) IN, 38°C (100°F)OUT
COLD 655 kPag (95 psig) @ 38°C (100°F) OUT, 30°C (86°F) IN
DUTY: 1850 kW (6.3 MMBtu/h)

HBG-1110A/B

CRUDE/CRUDE EXCHANGERS
DESIGN: HOT SIDE: 1379 kPag (200 psig) @ 93°C (200°F)
DESIGN: COLD SIDE: 1379 kPag (200 psig) @ 93°C (200°F)
OPERATING: HOT SIDE: 70 kPag (10 psig) @ 66°C (150°F)
OPERATING: COLD SIDE: 552 kPag (80 psig) @ 56°C (133°F)
DUTY: 3829 kW (13 MMBtu/h)

HBG-1115 (OUT OF OPERATION)

CRUDE HEATER
DESIGN: HOT SIDE: 1380 kPag (200 psig) @ 149°C (300°F)
DESIGN: COLD SIDE: 1380 kPag (200 psig) @ 149°C (300°F)
OPERATING: HOT SIDE: 345 kPag (50 psig) @ 135°C (275°F)
OPERATING: COLD SIDE: 517 kPag (75 psig) @ 66°C (150°F)
DUTY: 2804 kW (10 MMBtu/h)

HEAT MEDIUM SUPPLY DWG. 20-0149

4"-HM-A2-2509

0106 P-304 — MODULE 1 — PIPERACK

20-0104 10"-PL-A-1104 FROM BIJUPIRA PRODUCTION SEPARATOR 12"x10"

20-0103 10"-PL-A-1101 FROM TEST PRODUCTION SEPARATOR

20-0105 6"-PL-A-1107 FROM SALEMA PRODUCTION SEPARATOR

0106 P-305 — PIPERACK — MODULE 2

PIPERACK — MODULE 3 — 0106 P-306

12"-PL-A-1112

4"x6" SET @ 1379 kPag 61.2 CM² ORIFICE — PSV 1110-1

ESD — DO — IAS — SDY 3415-1 — SDV 3415-1

4"-PL-A-1164 — 20-0124 — FC 4"A5RS

8"-PL-A-1111

6"A2RF — 1/2"D2YF LO — 4"A2RF — SP 10 BLEED RING

4"-PL-A-1172

3/8" S.S. TUBING TO PSV-1110-1

6"-PL-A-1173

FROM OFF-SPEC TANK 0106 P-200 — SHIPSIDE — PIPERACK — MODULE 2

8"x4" — 8"A5RS — 8"A2RR — 8"A2RR — 1/2"D2YF

0,47

IAS — SDY 1110-1 — 0106 P-419

0,42

SDV 1110-1 — ZSO 1110-1 — DI — ESD — ZIO 1110-1

ESD — PI 1110-1 — PAHH: 635 kPag — AI — PT 1110-1 — 1/2"D2YF — PALL

ZSC 1110-1 — DI — ESD — ZIC 1110-1

PI 1110-1

3/8" SET @ 1967 kPag

20-0156 3/8"-CI-316-TUBING FROM PBE-3371D — 14

SAMPLE POINT SP 6 — 2"

INJECTION QUILL SCALE INHIBITOR SP 173

PI XXXX

0,59

12"A2RR — 1/2"D2YF — 1/2"G6SDS — 1/2"D2YF — 12"A2RR

SP 98 — 1"D2YF — BASKET STRAINER — 3/4" D2YF — 8"A2RR

PDI 1110-1

3/4"D2YF — TW 1110A-1 — 12"x8" — 2" — 8"A2RR — 8"-PL-A-1113

0,59

Removido

10"x8" — 10" — 0,26 — 10" — 2" — 2" — 8"A2RR

12"x10" — 10" — 2" — 8"A2RR

HBG-1110A

12"x10" 8"-PL-A-1120

2" — TW 1110A-3 — 12"-PL-A-1123

2"A2RR LC — 12"A2RR — 8"-PL-A-1122

2"-DC-A-5012

1"-PL-A-1138

2"-DC-A-5015

2"A2RR LC — 2" — TW 1110B-1

12"x10" — 10" — 0,52 — 10" — 2" — 2" — 8"A2RR

HBG-1110B

12"x10" — 2"A2RR LC — 2" — TW 1110B-3 — 12"-PL-A-1124

12"A2RF

8"-PL-A-1126

2"A2RR LC — 12"x10" — 10" — 2" — 2" — 8"A2RR

1"-PL-A-1115 — 1"-PL-A-1121

THERMAL 1"x1" SET @ 1379 kPag — PSV 1110A-2 — 1"A2RF — 1/2"D2YF LO — 1"A2RF LO — SP 20 BLEED RING

16"-PL-A-1114 — TI 1110A-4 — 2" — 16"x12" — 12"A2RR — BLEED RING

THERMAL 1"x1" SET @ 1379 kPag — PSV 1110A-1 — 1"A2RF — 1/2"D2YF LO — 1"A2RF LO — SP 20 BLEED RING

12"-PL-A-1118 — 1"-DC-A-5069

THERMAL 1"x1" SET @ 1379 kPag — PSV 1110B-2 — 1"A2RF — 1/2"D2YF LO — 1"A2RF LO — SP 20 BLEED RING

THERMAL 1"x1" SET @ 1379 kPag — PSV 1110B-1 — 1"A2RF — 1/2"D2YF LO — 1"A2RF LO — SP 20 BLEED RING

PDI 1110-3 — 1"-DC-A-5014

8"-PL-A-1119 — 8"A2RR — 12"x8" — 2"x1" — 1"-PL-A-1117 — 12"-PL-A-1116 — 2"A2RR LC — 8"-PL-A-1120

1"-PL-A-1125

1/2"D2YF — 1/2"D2YF — 12"-PL-A-1127

LO (NOTE 2) 12"A2RR — 2" — 12"A2RR LC — 1"-PL-A-1128

THERMAL 1"x1" SET @ 1379 kPag — PSV 1115-2 — 1"A2RF — 1/2"D2YF LO — 1"A2RF LO — SP 20 BLEED RING — 1"-PL-A-1139

TI 1115-5 — 2" — 12"A2RR LC (NOTE 2)

12"x4" REDUCING FLANGE — 12" — 0,14 — 12" — HBG-1115

2"A2RR LC — 1/2"D2YF — 12"A2RR LC (NOTE 2) — 2" — TT 1115-1

SAMPLE POINT SP 6 — 12"-PL-A-1133 TO IP SEPARATOR — 20-0107

THERMAL 1"x1" SET @ 1380 kPag — PSV 1115-1 — 1/2"D2SRXH — 1"A2RFXH LO — 1"A2RRXH LO — SP 27 BLEED RING

12"x4" REDUCING FLANGE — 1"-HM-A2-2520 — 2"

A2 — A — 1"-DC-A-5017 — 2"-DC-A-5016

PCS — AI — TAH — TI 1115-1 — TAL — TIC 1115-1 — AO — TO FQI-1125-1 — 20-0107

2"-DC-A-5023 — 2"A2RRXH LC — A — A2

TV 1115-1 — TY 1115-1 — 4"A2RRXH LC (NOTE 2) — 3/4"D2SRXH — FC — 4"A2RRXH LC (NOTE 2) — 4"A4RXH LC (NOTE 2)

4"-HM-A2-2510 — 1"HC — HEAT MEDIUM RETURN DWG. 20-0149

TO CLOSED DRAIN HEADER DWG. 20-0124

(NOTE 2) LC — 2" — 1 1/2"HC — 4"A5RS — 4"A2RRXH — 2"A2RRXH LC

20-0112 12"-PL-A-1112 FROM BGC 1st STAGE SUCTION SCRUBBERS

20-0110 2"-PL-A-1135 FROM FGC SUCTION BLOWCASES

20-0108 2"-PW-A-2012 FROM OIL TREATER WATER PUMPS

20-0147 4"-PL-A-1134 FROM FLOWLINE CIRCULATION PUMP

20-0121 2"-PW-A-2013 FROM WATER COLLECTION/SKIM VESSEL

12"-PL-A-1166

20-0103 10"-PL-A-1103 FROM SALEMA TEST PRODUCTION SEPARATOR

20-0104 10"-PL-A-1106 FROM BIJUPIRA PRODUCTION SEPARATOR

E-HOUSE — FC-4 — PT 1000-3 — TT 1000-2 — TE 1000-2 — TW 1000-2 — FT 1000-1A — (NOTE 1) — 1/2" 2"A2RF NO — 2" — 2" — 1" — 3"x10"

10"x3" — FLOW CONDITIONER — 10"x6"

20-0105 6"-PL-A-1109 FROM TEST PRODUCTION SEPARATOR

SAMPLE POINT SP 2A — 2"

20-103 10"-PL-A-1102 TO CRUDE/CRUDE EXCHANGER

20-104 10"-PL-A-1105 TO CRUDE/CRUDE EXCHANGER

MODULE 1

10"-PL-A-1110

10"x6"

20-105 6"-PL-A-1108 TO CRUDE/CRUDE EXCHANGER

COOLING WATER SUPPLY DWG. 20-0143

TO CLOSED DRAIN HEADER DWG. 20-0124

PDI 1110-2 — 8"-WI-N-2101

PDI 1150-1 — 1/2"D2YF — 1/2"D2YF

12"-PL-A-1168 — 1"-DC-A-5070

BSW 1150-1 — AAH — PCS — AI — TW 1150-4 — 2" — 8"N2FR — 8"N5FW — 1/2" — 12"x8" — 12"

THERMAL 1"x1" SET @ 1035 kPag — PSV 1150-2 — ESD — I — S — SDY 1150-1 — IAS — 1"A2RF — 1/2"D2YF LO — 1"A2RF LO — 2"x1" — 2"N2FR LC — SP 20 BLEED RING

16"-PL-A-1114 — 12"A2RR — 16"A2RR — BSW 1150-1 — TI 1150-1 — 3" — 2" — 2"A2RR LC — 12" — 16"x12" — 12"

1"-PL-A-1170 — 1/2" — N — A

2"BLIND FLANGE — 3/4" SPARE

HBG-1150 OUT OF OPERATION

TW 1150-3 — 2" — 12"x8" — 12"

SDV 1150-1 — FC — 16"-PL-A-1131

PCS — AI — TAH — TI 1150-2 — SAMPLE POINT SP 1A — 2" — TT 1150-2 — 2"

2"A2RR LC — 2"x1" — 1"-DC-A-5018 — 1"A2RF LO — 1/2"N2SR — SP 26 BLEED RING — 1"N2FF LO

THERMAL 1"x1" SET @ 1035 kPag — PSV 1150-1

1"-WI-N-2125 — 8"N2FR LO. — 8"-WI-N-2102 — COOLING WATER RETURN DWG. 20-0143

2"N2FR LC — 2"-DC-A-5022

2"-DC-A-5012

TO CLOSED DRAIN HEADER DWG. 20-0124 — TO CLOSED DRAIN HEADER DWG. 20-0124

16"-PL-A-1129 — 1/2"D2YF — 16"x12" — 1/2"D2YF

0106 P-501 — 16"x12" — 12"-PL-A-1129 — 20-0108 FROM ELECTROSTATIC TREATER "A"

0106 P-500 — MODULE 2 — HOOK-UP — MODULE 3 — 16"x12" — 12"-PL-A-1132 — 20-0109 FROM ELECTROSTATIC TREATER "B"

MODULE 2 — SHIPSIDE PIPERACK — 0106 P-201

16"-PL-A-1131 — 20-0175 TO FISCAL METERING SYSTEM (ZZZ-1160)

NOTES:
1. FOR MORE DETAILS CHECK 5004-ODS20-9020-0024.
2. HBG-1115 IS OUT OF SERVICE. NEED TO ISOLATE THE EQUIPMENT.

NOTE:
THIS WORK HAS BEEN DEVELOPED BY A PIPING DESIGNER AND CONTEMPLATES PIPING VISUAL INSPECTION, FLANGES, VALVES, AND INSTRUMENTS CONNECTIONS. THE LOGICAL SYSTEM VERIFICATION AND ALSO ELETRIC SYSTEM ARE NOT INCLUDED.

NO.	BY	REVISION DESCRIPTION	DATE	CHK'D.	APPV'D.
11	MSA	AS BUILT & REMOVED CLOUDS	10/10/12	MSA	LD/RD
10	HGF	AS BUILT/REVISED AS NOTED	10/05/10	MH	CCP
14	RSN	REVISED ACCORDING MOC 1284	10/01/17	TL/VL	TL/VL
13	RSN	REVISED ACCORDIND MOC 1222	24/06/16	PL	PL
12	RSN	REVISED ACCORDING MOC 876	07/10/15	VA	VA

CLIENT: ENTERPRISE OIL — Bijupira & Salema

Indicativo de NORM
Sem indicativo de NORM
Sem acesso
Todas as medidas estão em µSv/h

MODULE 2

CONFIDENTIAL PROPRIETARY INFORMATION

DRAWN BY:	CH
DWG DATE:	
DWG SCALE:	NONE
AT	D SIZE
SHEET:	
CAD FILE:	01-20-0106

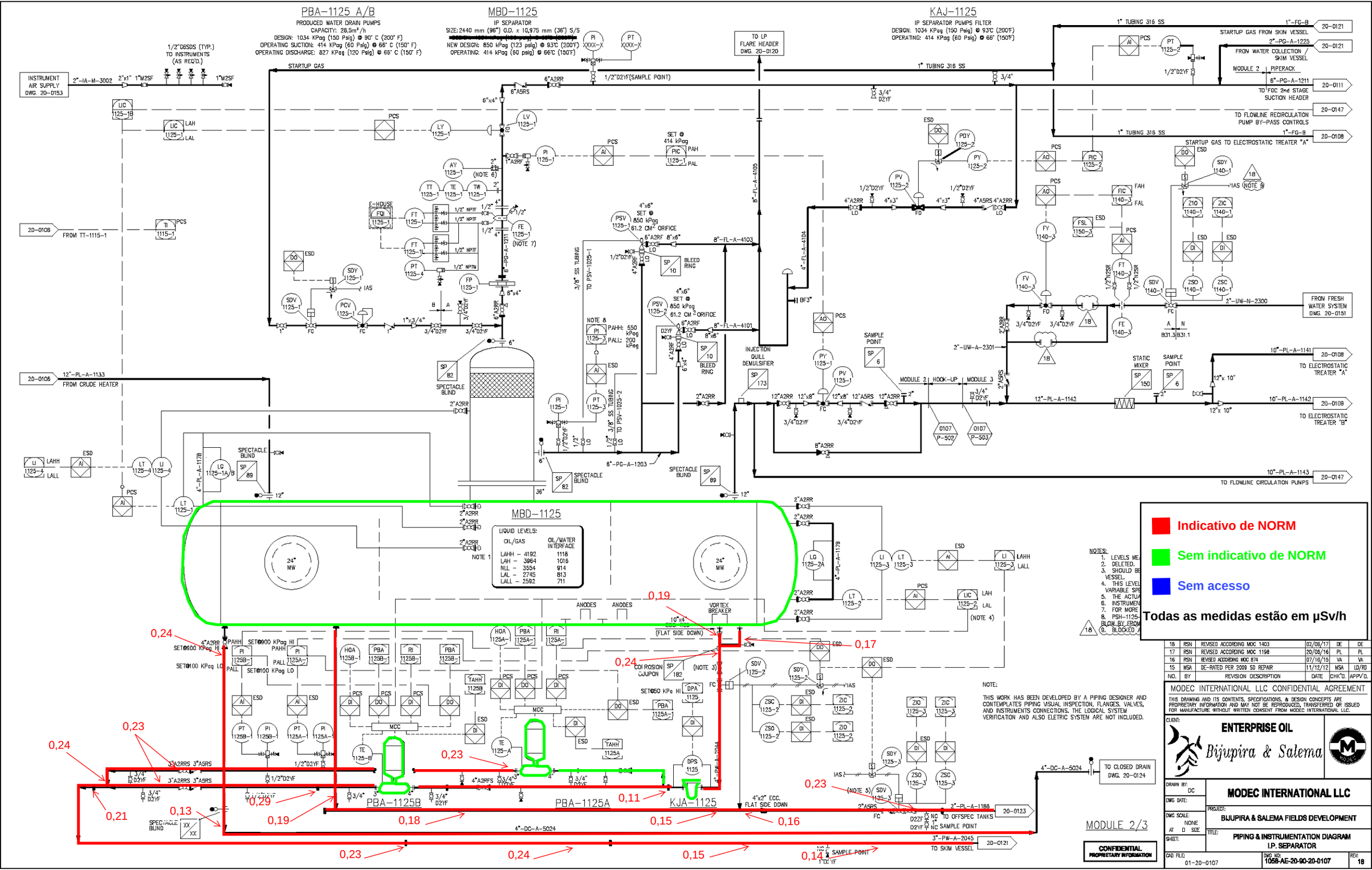
MODEC INTERNATIONAL LLC

PROJECT: BIJUPIRA & SALEMA FIELDS DEVELOPMENT

TITLE: PIPING & INSTRUMENTATION DIAGRAM
CRUDE EXCHANGER / HEATER / SALES OIL COOLER

DWG NO: 1058-AE-20-90-20-0106

REV: 14


PBA-1125 A/B
PRODUCED WATER DRAIN PUMPS
CAPACITY: 28,5m³/h
DESIGN: 1034 KPag (150 Psig) @ 90° C (200° F)
OPERATING SUCTION: 414 KPag (60 Psig) @ 66° C (150° F)
OPERATING DISCHARGE: 827 KPag (120 Psig) @ 66° C (150° F)
MBD-1125
IP SEPARATOR
SIZE:2440 mm (96") O.D. x 10,975 mm (36") S/S
NEW DESIGN: 850 KPag (123 psig) @ 93°C (200°F)
OPERATING: 414 KPag (60 psig) @ 66°C (150°F)
KAJ-1125
IP SEPARATOR PUMPS FILTER
DESIGN: 1034 KPag (150 Psig) @ 93°C (200°F)
OPERATING: 414 KPag (60 Psig) @ 66° (150°F)
TO LP FLARE HEADER DWG. 20-0120
STARTUP GAS
STARTUP GAS FROM SKIN VESSEL
FROM WATER COLLECTION / SKIM VESSEL
TO FGC 2nd STAGE SUCTION HEADER
TO FLOWLINE RECIRCULATION PUMP BY-PASS CONTROLS
STARTUP GAS TO ELECTROSTATIC TREATER "A"
FROM FRESH WATER SYSTEM DWG. 20-0151
FROM TT-1115-1
FROM CRUDE HEATER
SPECTACLE BLIND
INJECTION QUILL DEMULSIFIER
SAMPLE POINT
STATIC MIXER
TO ELECTROSTATIC TREATER "A"
TO ELECTROSTATIC TREATER "B"
TO FLOWLINE CIRCULATION PUMPS
MBD-1125
LIQUID LEVELS:
OIL/GAS
OIL/WATER INTERFACE
LAHH - 4192 1118
LAH - 3964 1016
NLL - 3554 914
LAL - 2745 813
LALL - 2592 711
ANODES
VORTEX BREAKER
CORROSION COUPON
PBA-1125B
PBA-1125A
KJA-1125
TO CLOSED DRAIN DWG. 20-0124
TO OFFSPEC TANKS
TO SAMPLE POINT
TO SKIM VESSEL
MODULE 2/3
Indicativo de NORM
Sem indicativo de NORM
Sem acesso
Todas as medidas estão em µSv/h
NOTES:
THIS WORK HAS BEEN DEVELOPED BY A PIPING DESIGNER AND CONTEMPLATES PIPING VISUAL INSPECTION, FLANGES, VALVES, AND INSTRUMENTS CONNECTIONS. THE LOGICAL SYSTEM VERIFICATION AND ALSO ELETRIC SYSTEM ARE NOT INCLUDED.
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CLIENT:
ENTERPRISE OIL
Bijupira & Salema
MODEC INTERNATIONAL LLC
PROJECT:
BIJUPIRA & SALEMA FIELDS DEVELOPMENT
TITLE:
PIPING & INSTRUMENTATION DIAGRAM
I.P. SEPARATOR
DWG NO: 1058-AE-20-90-20-0107
REV: 18
CONFIDENTIAL PROPRIETARY INFORMATION