

SHAMS POWER COMPANY

ENGINEERING DIVISION

INSPECTION & CORROSION SECTION

SHAMS 1

LOCATION : 1 R1HAD11-BC010

KKS : 1 R1HAD11-BC010

GRADE & CLASSIFICATION : 2

CERTIFICATE OF INSPECTION

The equipment detailed below was examined in accordance with the SHAMS code of practice for plant inspection,

ITEM : Evaporator (SGG-1)

LOCATION : SHAMS Plant

TYPE OF INSPECTION : Major

DATE OF INSPECTION : March, 2020

PLACE OF INSPECTION : IN-SITU

DATE OF LAST INSPECTION : N/A

REPORT :

1.0. SUMMARY

The above Evaporator (SGG-1) was taken off line, isolated, opened, vented & cleaned for major external & internal inspections.

2.0. SUBJECT

2.1. This is a horizontal carbon steel shell with carbon steel tube bundle.

Item	Shell Side	Tube side
Design pressure	120 bar	25 bar
Design temperature	398C	398 C
Operation pressure	-	-
Operation temperature	-	-
Hydro test pressure	209.25 bar	42.47 bar
Fluid	Water / Steam	HTF
Material	A 516 Gr 70	A556 -B2
Tube Number		1826 U
Tube diameter		5/8 inch
Tube thickness	25 mm	2.11 mm
Tube length		9170 mm

The above equipment is/ is not considered suitable for further service under the present operating conditions

NEXT MAJOR INSPECTION DUE : March 2024

INSPECTED: Osman Ismail

ENDORSEMENT: 48 MONTHS

REVIEWED: Ali Al Masabai

3.0 History

This Evaporator (SGG-1) was commissioned in 2013. Periodical inspection records since Oct.'2014 are available. Diaphragm was reported leaking since 3 years ago, and it was stopped using farmanite outside clamp. During this outage diaphragm replaced by new one.

4.0. Scope of Inspection

- 4.1 Visual Inspection
- 4.2 Remote field Eddy Current (RFT)
- 4.3 Ultrasonic Thickness survey
- 4.4 Dye- penetrant
- 5.4 Borescope inspection

5.0. CONDITIONS FOUND

5.1. External (Shell side)

- 5.1.1 All painting and insulation found intact without any evidence of painting peel off or blistering and no evidence of any damage for insulation or insulation cover aluminum sheet.
- 5.1.2 All ladders, stairways and handrails found in satisfactory condition.
- 5.1.3 All concrete support found in satisfactory condition without evidence of cracking or spalling.
- 5.1.4 All external piping insulation found in satisfactory condition.
- 5.1.5 All earthing lugs found in satisfactory condition.

5.2. Internal (Tube side)

- 5.2.1 All tubes as could see internal surfaces found satisfactory condition without evidence of corrosion, apart from a considerable amounts of deposits which have cleaned by high pressure hydro jetting.
- 5.2.2 All tube to tube sheet welds found in satisfactory condition.
- 5.2.3 Diaphragm was cut out for tube inspection access and welded back and dye-penetrant tested successfully.
- 5.2.4 Chemical analysis carried out for deposit sample found normal.

6.0 NDT

6.1 Ultrasonic thickness survey

Ultrasonic thickness measurement was carried out on accessible locations of channel found satisfactory. See attached thickness measurement report.

6.2 Dye – Penetrant test

Dye – Penetrant test was carried out on tube to tube sheet welds and new welds of diaphragm all found satisfactory. See attached thickness measurement report.

6.3 Remote field Eddy Current test (RFT)

Eddy current test was carried out on 100 tubes as sample out of total nos. 1826, results was satisfactory. More details in the attached RFT report.

Classifications	Total
No Defects Detected	68
0.1% - 10% Volume Loss	11
10%- 20% Volume Loss	19
20%- 30% Volume Loss	02
30%- 40% Volume Loss	0
40.0%- 50% Volume Loss	0
50.0 +Volume Loss	0
Restricted	0
Obstructed	0
Plugged	0

6.4 borescope Inspection

It was done internally from tube side end and externally of tubes from shell side end. It revealed a considerable amount of deposit inside tubes, while outside was satisfactory. After hydro jetting deposits was less but not removed completely, (see attached videos and photos)

6.7 Chemical Analysis

Chemical analysis was carried out through third party called GEO –CHEM MIDDLE EAST, results was normal.

7.0. Recommendations

Evaporator (SGG-1) to be open for inspection after four years as per SHAMS code of practice.

8.0 Inspection Grade and Interval

In accordance with the latest revision of SHAMS Code of Practice, this Evaporator (SGG-1) was endorsed for 48 months under class 2, for next Major Inspection.

FREQUENCY : 48 MONTHS.
ENDORSEMENT : 48 MONTHS,
GRADE : 2
Next Major Insp. due : March, 2024

Photos

 A large, circular metal plate with a red Furmanite clamp attached to its edge. The plate is positioned between two vertical metal structures.	 A close-up view of a large, circular metal plate with a new diaphragm installed. The plate is surrounded by several brown, cylindrical components.
Furmanite Clamp	New diaphragm

Attachments

- **RFT Report**
- **Borescope Report**
- **Deposit Chemical analysis Report**

RFT REPORT

Client: SHAMS POWER	DATE: 21st March 2020
Site: Madinat Zayed, Abu Dhabi	Rep Ref: EVA1 MAR 2020 -02
Equipment Serial No: EVAPORATOR 1	Tube Orientation: U Tube
Operator\Analyst: Srinivas Rao (BHS)	
Tube Dimension: - OD: 15.87mm Thickness: 2.11mm Tube Length:	Material: CS
Method: RFT	Equipment\System: Ectane 2 Sr No.1925606
Total No of Tubes: 1826 Nos	Tubes Inspected: 100 nos
	Maximum defect 29%
Comments: Tubes were found as fairly cleaned conditions. Oil deposits and sludge's found throughout the tubes, mainly in the bottom portion of the exchanger. Hence tubes from the top portion are randomly selected for inspection.	
Result: Out of 100 tubes, 02 tubes are found with corrosion at a range between 20-30% near U bend area. 19 tubes are found with pitting/wall loss between 10-20%, 10 tubes between 1-10%. Remaining 69 tubes found with no major indications.	
Tube counting: Rows are counted from top to bottom and columns from left to right side of the tube sheet.	
WLL: Wall Loss, NDD: No Defect Detected, RST: Restricted	

Row	Column	Defect	Evaluation	Remarks
1	1	0 %		NDD
1	2	0 %		NDD
1	3	0 %		NDD
1	4	0 %		NDD
1	5	12.0 %		PIT
1	6	0 %		NDD
1	7	0 %		NDD
1	8	0 %		NDD
1	9	0 %		NDD
1	10	14.0 %		PIT
1	11	0 %		NDD
1	12	0 %		NDD
1	13	0 %		NDD
1	14	0 %		NDD
1	15	11.0 %		PIT
1	16	0 %		NDD
1	17	0 %		NDD
1	18	0 %		NDD
1	19	0 %		NDD
1	20	0 %		NDD
5	1	9.0		PIT
5	10	8.0		PIT
5	15	9.0		WLL

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5	20	8.0		WLL
5	25	11.0		WLL
5	26	0 %		NDD
5	27	0 %		NDD
5	28	0 %		NDD
5	29	0 %		NDD
5	30	9.0		WLL
5	31	0 %		NDD
5	32	0 %		NDD
5	33	0 %		NDD
5	35	17.0 %		PIT
10	1	9.0		WLL
10	2	0 %		NDD
10	3	0 %		NDD
10	4	0 %		NDD
10	5	16.0		PIT
10	6	0 %		NDD
10	7	0 %		NDD
10	8	0 %		NDD
10	9	0 %		NDD
10	10	14.0 %		PIT
10	11	0 %		NDD
10	12	0 %		NDD
10	13	0 %		NDD
10	14	0 %		NDD
10	15	0 %		NDD
10	20	8.0		PIT
10	30	9.0		PIT
10	40	13.0		PIT
10	50	12.0		WLL
10	57	14.0		WLL
15	1	12.0		PIT
15	10	13.0		PIT
15	20	12.0		WLL
15	21	0 %		NDD
15	22	0 %		NDD
15	23	0 %		NDD
15	24	0 %		NDD
15	25	0 %		NDD
15	26	0 %		NDD

15	27	0 %		NDL
15	28	0 %		NDL
15	29	0 %		NDL
15	30	13.0		WLL
15	40	18.0		COR
15	50	14.0		COR
15	63	29.2 %		COR
20	58	0 %		NDL
20	59	0 %		NDL
20	60	0 %		NDL
20	61	0 %		NDL
20	62	0 %		NDL
20	63	0 %		NDL
20	64	0 %		NDL
21	1	0 %		NDL
21	2	0 %		NDL
25	1	12.0		WLL
25	10	9.0		WLL
25	20	17.0		PIT
25	21	0 %		NDL
25	22	0 %		NDL
25	23	0 %		NDL
25	24	0 %		NDL
25	25	0 %		NDL
25	26	0 %		NDL
25	27	0 %		NDL
25	28	0 %		NDL
25	29	0 %		NDL
25	30	0 %		NDL
25	31	0 %		NDL
25	32	0 %		NDL
25	33	0 %		NDL
25	34	0 %		NDL
25	35	0 %		NDL
30	30	8.0		WLL
30	40	16.0 %		PIT
30	50	28.0 %		COR

TECHNICIAN	TPI	CLIENT
Name : Srinivas Rao		

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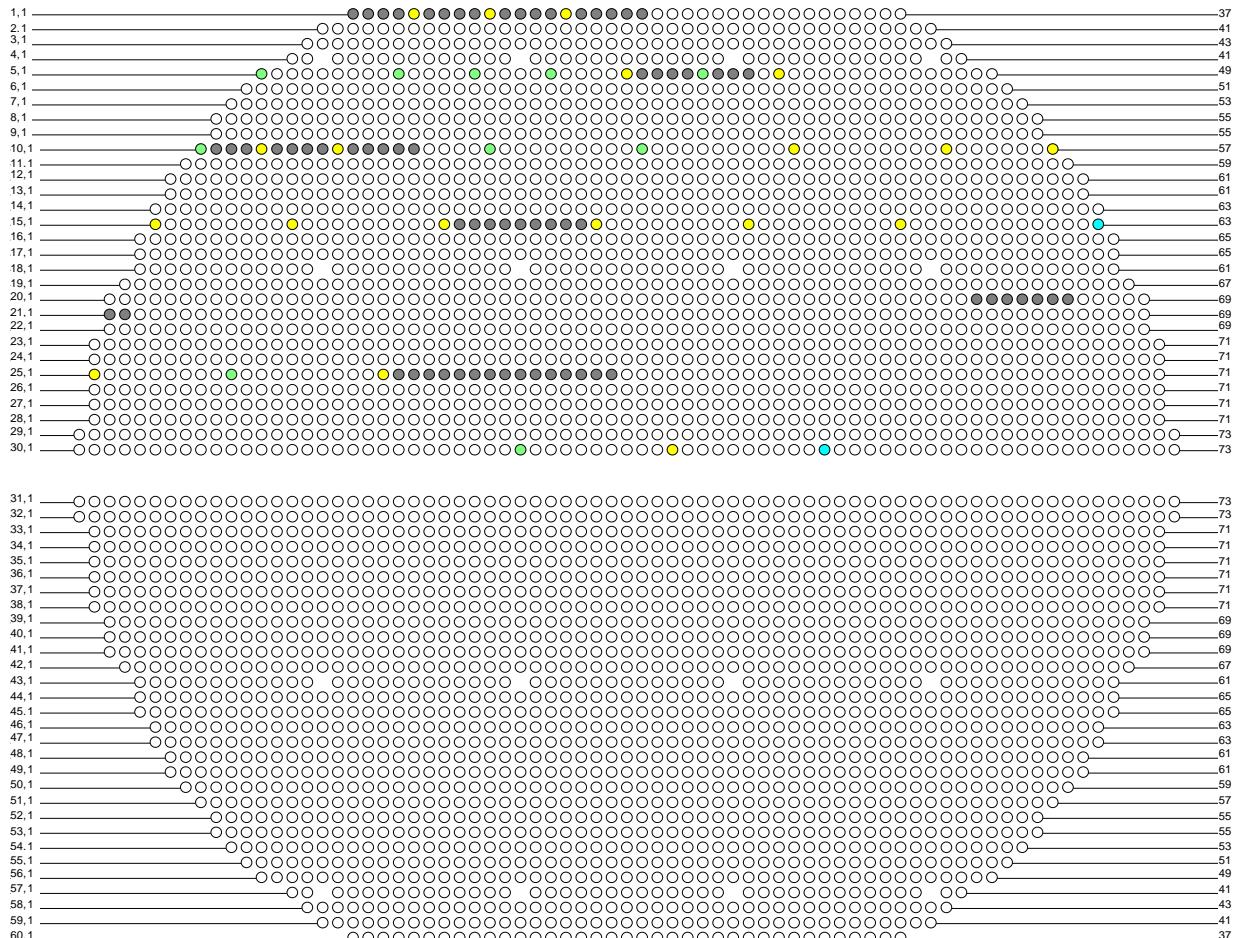
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Signature :		
Date :	18 th & 21 st March 2020	

HEAT EXCHANGER DRAWING



DESC	SYMBOL	QTY	DESC	SYMBOL	QTY
Tube Count	○	3652	30-40	●	0
Number Inspected	○	100	40-50	●	0
NDD	●	69	50-60	○	0
0-10	●	10	60+	●	0
10-20	●	19	Plugged	●	0
20-30	●	2	RST	⊕	0

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Form No.: IN-QSF-36 Rev. 05E Dtd.: 20-10-2018

ULTRASONIC THICKNESS GAUGING REPORT

Client: SHAMS POWER COMPANY			
Date:	18.03.2020	Report No.:	AD / 485
Project:	SHAMS OUTAGE MARCH 2020	Job No.:	N/A
Location:	MADINAT ZAYED	Drawing No.:	N/A
Item ID:	EVAPORATOR-1	Material:	CS
Ref/ Procedure No:	INSPEC/UTG/001 Rev.10	Ref. Standard:	ASME SEC V
UTG Equipment Model/ Manufacturer:	USM 35 X DAC / GE	Serial No.:	7292a
Calibration Block No. :	STEP WEDGE, IIW V2 BLOCK	EQPT Calibration Certificate & Due Date:	INS/UT/CAL-043/19/AUH
Probe Type/ Size/Frequency:	WK TR 0° PROBE/ 10mm DIA / 5 MHz	Couplant Brand Name & Type:	POLYCELL + WATER
Connecting Cable Type & Length:	LEMO TO MICRODOT & 2 MTR	Special Attachment/ Equipment/ Block:	STEP WEDGE BLOCK (SL NO : AZB270)
Test Temperature:	AMBIENT	Surface Condition:	AS CLEANED
Inspection Date:	18.03.2020	Page:	1 of 2
Description:			

ULTRASONIC THICKNESS GAUGING WAS CARRIED OUT ON THE FOLLOWING EVAPORATOR-1 (R1HAD11 BC010)

LOCATION	ORIENTATION	MEASURED THICKNESS (mm)
1	12 O'CLOCK	30.58
1	3 O'CLOCK	30.54
1	6 O'CLOCK	30.58
1	9 O'CLOCK	30.69

REPORT FORMAT APPLICABLE ONLY FOR AUH & FUJ FACILITY

LEVEL II TECHNICIAN	CLIENT REPRESENTATIVE	AI / TPI
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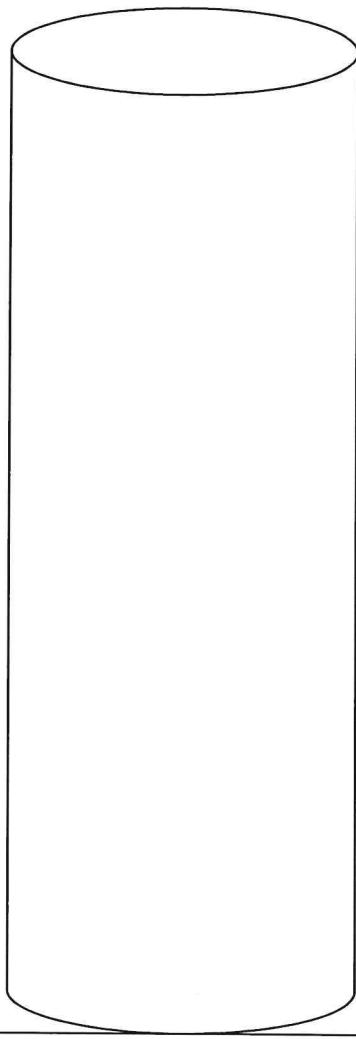
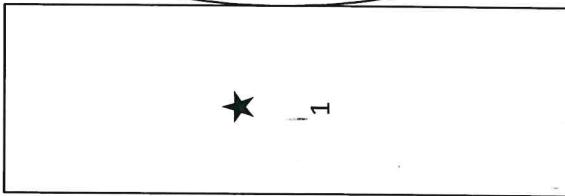
Intertek.com

International Inspection Services Ltd

Date :- 18.03.2020
Report No.: - AD-485
Page No. :- 2 OF 2

ULTRASONIC THICKNESS SCANNING DRAWING SHEET

EVAPORATOR - 1



★ UTG LOCATION

LEVEL II TECHNICIAN SIGN
Name: MO SIVANESAN & RAJESH KANNAN
Sign: 660 Date: 18.03.2020



International Inspection Services Ltd.

NON-DESTRUCTIVE TESTING, HEAT TREATMENT, ADVANCED INSPECTION SERVICES,
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Laboratory: E-mail: lab.dubai@geochemglobal.com, Operation: Email: operations.dubai@geochemglobal.com
ISO 9001:2015 CERTIFIED COMPANY
www.geochem.ae

LABORATORY REPORT

Date Reported: 24/03/2020
Date Received: 19/03/2020

Report No: GC/LR/829977/2020
Sample No.: GC/829977

To,

Shams Power Company PJSC
Masdar City, SAF-1
PO Box 54115,
Abu Dhabi, UAE
Tel : +971 561883624

For the Attention of	:	Mr. Rommel dela Pena Acda
Sample Received from	:	Shams Power Company PJSC
Sample(s) submitted as	:	Deposit Sample [1 X 500 gm Plastic Bag]
Description(s) on Label(s)	:	As per attached sheets
Seals on Sample(s)	:	Nil

The above sample(s) was/were examined as detailed below and the following results obtained:
Please refer attached sheets for analytical results. Total no. of pages : 03 (incl. cover page)
QA.LD/52; Revision: 02; Revision Date: 15/01/2019

LABORATORY REPORT

Date Reported: 24/03/2020
 Date Received: 19/03/2020

Report No: GC/LR/829977/2020
 Sample No.: GC/829977

Description(s) on Label(s) : SSG-1 Evaporator Deposit
 Dated: 18/03/2020

Test	Method	Unit	Result
Loss On Ignition:		-	-
@550 °C	Gravimetry	% wt	1.36
@750 °C		% wt	0.05
Sulphate	Gravimetry	mg/kg	<10.0
Silicon Dioxide	Gravimetry	% wt	2.23
Chloride	Titration	% wt	0.03
Phosphate		% wt	0.09
Calcium Chloride		% wt	5.96
Moisture		% wt	2.06
Silver		% wt	<0.01
Aluminium Oxide		% wt	0.18
Titanium Dioxide		% wt	0.02
Calcium Oxide		% wt	3.0
Magnesium Oxide		% wt	0.21
Sodium Oxide		% wt	0.03
Potassium Oxide		% wt	0.01
Copper Oxide		% wt	0.17
Zinc Oxide		% wt	0.12
Manganese Oxide		% wt	0.23
Vanadium		% wt	<0.01
Molybdenum		% wt	<0.01
Antimony		% wt	<0.01
Tin		% wt	<0.01
Lithium		% wt	<0.01
Barium		% wt	0.01
ICP-OES			

جیو - کیم میدل ایست

GEO-CHEM MIDDLE EAST

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LABORATORY REPORT

Date Reported: 24/03/2020

Date Received: 19/03/2020

Report No: GC/LR/829977/2020

Sample No.: GC/829977

Test	Method	Unit	Result
Cadmium	ICP-OES	% wt	<0.01
Cobalt		% wt	0.01
Chromium Oxide		% wt	0.47
Nickel		% wt	0.39
Phosphorous		% wt	0.03
Lead		% wt	<0.01
Selenium		% wt	<0.01
Beryllium		% wt	<0.01
Strontium		% wt	<0.01
Arsenic		% wt	<0.01
Iron Oxide:		-	-
FeO		% wt	46.10
Iron Oxide (Fe ₂ O ₃)		% wt	41.59

Test conducted on

19-23/03/2020

Test method deviation:

None

Sampling method

Sampled by Client

Test conducted by Emp:

877, 586

Report prepared by Emp:

432

The above test results are only applicable to the sample(s) referred above

REPORTED BY



PRADEESH PRADEEP

LABORATORY MANAGER

The test report shall not be reproduced (except in full) without the written approval of Geo-Chem Middle East
Samples retention period as per procedure QP/12, which shall be provided on request.

QA.LD/52; Revision: 02; Revision Date: 15/01/2019

END OF REPORT



BOROSCOPE TESTING REPORT

CLIENT: SHAMS POWER COMPANY

EVAPORATOR-2

EQUIPMENT NO: R1HAD11-BC020

REPORT No.: INS/BOR/SHAMS/005/2020

DATE: 14/03/2020



Prepared By:	Reviewed By:	Reviewed By:	Approved By:
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TABLE OF CONTENTS

SECTION	DESCRIPTION
1.0	BOROSCOPY TESTING REPORT (INS/BOR/SHAMS/005/2020)
2.0	CERTIFICATES • INSPECTOR CERTIFICATE

1.0 BOROSCOPY TESTING REPORT

a) EVAPORATOR-2 (R1HAD11-BC020) TUBE BUNDLE

a) EVAPORATOR-2 (R1HAD11-BC020) TUBE BUNDLE

Form No.: IN-OPF-41 Rev. 05 Dtd.: 20-03-2019

BOROSCOPE TESTING REPORT

Report No.:	INS/BOR/SHAMS/005/2020	Date:	14-Mar-20	Page:	1	Of	1
Client :	SHAMS POWER COMPANY	Equipment :	R1HAD11-BC020				
Location :	MADINAT ZAYED						
Item :	EVAPORATOR-2	Type of construction:	U TUBE				
Equipment :	OLYMPUS IPLEX FX	Specification :					
Serial No. :	Y104888	Photographs :	ATTACHED				

Description :-

Boroscope inspection was carried out on EVAPORATOR-2 (R1HAD11-BC020)

Observations:-

Refer attachment for details.

Note:-

The above observations were as per the client who had witness the inspection.

TECHNICIAN / INSPECTOR

Name :	SIBIN.V.V
Sign :	
Date :	14-Mar-20
Dubai Branch Sharjah Branch Abu Dhabi Branch Fujairah Branch Oman Branch Registered Office	

: P O Box: 96535, Dutsal, U.A.E
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: P O Box: 41227, Abu Dhabi, U.A.E
: P O Box: 7907, Fujairah, U.A.E
: P O Box: 193, P.C. 131, Sultanate of Oman
: 33-37 Athol Street, Douglas, IM1, 1LB, Isle of Man. Company Number 010728V.

CLIENT REP.

Name :	
Sign :	
Date :	
Tel : 04 3241955	Fax: 04 3241957
Tel : 06 5061300	Fax: 06 5361173
Tel : 02 6225820	Fax: 02 6225830
Tel : 09 2238754	Fax: 09 2238754
Tel : 00968 2448 2391	Fax: 00968 2448 5855

AI / TPI

Name :	
Sign :	
Date :	
Email: inspec.dxbcoor@intertek.com	INSPEC IS PART OF INTERTEK GROUP
Email: inspec.shcoor@intertek.com	
Email: inspec.adhcoor@intertek.com	
Email: inspec.fujcoor@intertek.com	
Email: inspec.muscat@intertek.com	

For Complaints & Suggestions:
Please email to: suggestions.inspec@intertek.com

Form No.: IN-OPF-41 Rev. 05 Dtd.: 20-03-2019

BOROSCOPE TESTING REPORT

Report No.:	INS/BOR/SHAMS/005/2020	Date:	14-Mar-20	Page:	1	Of	1
Client :	SHAMS POWER COMPANY	Equipment :	R1HAD11-BC020				
Location :	MADINAT ZAYED						
Item :	EVAPORATOR-2	Type of construction:	U TUBE				
Equipment :	OLYMPUS IPLEX FX	Specification :					
Serial No. :	Y104888	Photographs :	ATTACHED				

Description :-

Boroscope inspection was carried out on EVAPORATOR-2 (R1HAD11-BC020)

Observations:-

Refer attachment for details.

Note:-

The above observations were as per the client who had witness the inspection.

TECHNICIAN / INSPECTOR

Name :	SIBIN.V.V
Sign :	
Date :	14-Mar-20
Dubai Branch : P O Box: 96535, Dubai, U.A.E	
Sharjah Branch : P O Box: 61210, Sharjah, U.A.E	
Abu Dhabi Branch : P O Box: 41227, Abu Dhabi, U.A.E	
Fujairah Branch : P O Box: 7907, Fujairah, U.A.E	
Oman Branch : P O Box: 193, P.C: 131, Sultanate of Oman	
Registered Office : 33-37 Athol Street, Douglas, IM1, 1LB, Isle of Man. Company Number 010728V.	

CLIENT REP.

Name :		Name :	
Sign :		Sign :	
Date :		Date :	

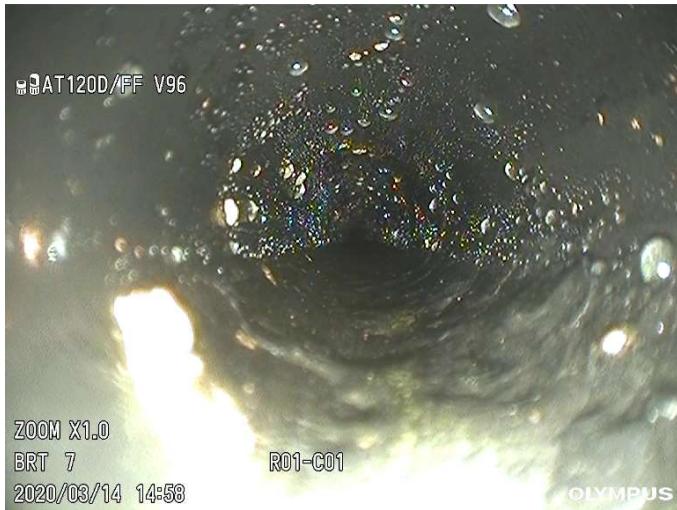
AI / TPI

Name :	Fax: 04 3241957	Email: inspec.dxbcoor@intertek.com	INSPEC IS PART OF INTERTEK GROUP
Sign :	Fax: 06 5061300	Email: inspec.shicoor@intertek.com	
Date :	Tel : 02 6225820	Email: inspec.adhcoor@intertek.com	
	Tel : 09 2238754	Email: inspec.fujcoor@intertek.com	
	Fax: 09 2238754	Email: inspec.muscat@intertek.com	
	Tel : 00968 2448 2391		
	Fax: 00968 2448 5855		

For Complaints & Suggestions:
Please email to: suggestions.inspec@intertek.com

Please see terms & conditions. This report is valid only if signed and stamped (Numbered Stamp) by Technician / Inspector

BOROSCOPE INSPECTION REPORT

ROW-6 TUBE-10	ROW-6 TUBE-10
 <p>■ AT120D/FF V96</p> <p>ZOOM X1.0 BRT 6 R01-C01 2020/03/14 14:56</p> <p>OLYMPUS</p>	 <p>■ AT120D/FF V96</p> <p>ZOOM X1.0 BRT 7 R01-C01 2020/03/14 14:56</p> <p>OLYMPUS</p>
Observation:	Black stain and minor deposits found in visual inspection

ROW-6 TUBE-10	ROW-6 TUBE-10
 <p>■ AT120D/FF V96</p> <p>ZOOM X1.0 BRT 7 R01-C01 2020/03/14 15:00</p>	 <p>■ AT120D/FF V96</p> <p>ZOOM X1.0 BRT 7 R01-C01 2020/03/14 14:56</p> <p>OLYMPUS</p>
Observation:	Black stain and minor deposits found in visual inspection

2.0 CERTIFICATE

**INTERNATIONAL INSPECTION SERVICES LTD
(INTERTEK – INSPEC)
P. O. BOX 96535, DUBAI, U.A.E.**

C E R T I F I C A T E

Date of Assignment : 02nd August 2016

Certificate No : INS/VT/16/858

Issue Date : 02nd August 2016

Expiry Date : 01st August 2021

This is to certify

Mr. SIBIN V.V

Has demonstrated his ability successfully in both written and Practical examinations following training in accordance with the INTERTEK-INSPEC written Practice Document No. INS/SNT/WP/01 Revision 00 which is based on ASNT SNT TC 1A – 2006 edition in the following method and level shown below:

Method : Visual Testing. (Remote Visual Inspection by Fiber Optics)

Level : II (Two)

RESULTS	GRADE
General Examination	85.0%
Specific Examination	85.0%
Practical Examination	86.0%
Total for Average	256.0
Composite	85.33%



This certificate is only valid whilst the above person is employed by INTERTEK-INSPEC.



Intertek- INSPEC Certifying Authority

NDT Level III

Prolongation of validity

Date of renewal	Reference Document	Date of expiry	Examiner	Employer