COMPRESSOR FAT TEST PROCEDURE

Rev.	Date	Purpose of Issue	Prepared	Checked	Approved	AC Code
01	10/02/2022	For approval	KP	LdM	JR	
00	12/11/2021	For approval	KP	LdM	JR	
					Class: 1	Phase: P

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1. Purpose

Checking the performance and functioning of the package against the approved documents and specifications.

Separate test reports for each test will be generated; however, this FAT procedure covers only the procedure to be performed on all skids.

2. Reference documents

2.1. Vendor documents

Please find below the reference vendor documents that will be used during this FAT.

BU-20-VD-303-PR-DWG-0013 BU-20-VD-303-PR-DWG-0066	17811-03A/B	P&ID
BU-20-VD-303-ME-DWG-0023 BU-20-VD-303-ME-DWG-0076	17811-04A/B	General Arrangement Drawing
BU-20-VD-303-IN-DIG-0043 BU-20-VD-303-IN-DIG-0093	17811-05A/B	Wiring Diagram
BU-20-VD-303-IN-DWG-0039 BU-20-VD-303-IN-DWG-0089	17811-06A/B	Panel lay-out
BU-20-VD-303-QC-ITP-0005	17811-08	Inspection & Test Plan (ITP)
BU-20-VD-303-PR-DPH-0046 BU-20-VD-303-PR-DPH-0095	17811-21A/B	Control Philosophy
BU-20-VD-303-PR-LST-0042 BU-20-VD-303-PR-LST-0092	17811-27A/B	Cause and Effect chart
BU-20-VD-303-IN-LST-0037	17811-36A/B	Trip and alarm set point list
BU-20-VD-303-IN-LST-0034 BU-20-VD-303-IN-LST-0084	17811-06A/B	IO list
BU-20-VD-303-IN-LST-0057 BU-20-VD-303-IN-LST-0102	17811-56A/B	Modbus list
BU-20-VD-303-EL-DWG-0058 BU-20-VD-303-EL-DWG-0059	17811-57A/B	Power distribution panel drawing

2.2. Manufacturing data book

The manufacturing data book will also be available for review during the FAT. The MDB will be checked according to the approved MDB index and ITP.

The client or client TPI will sign the relevant pages as well as all relevant point of the ITP.

3. Scope

The scope of supply is as follows

1. One (1) Nitrogen Compressor (outlet capacity 90 Nm3/hr), oil free reciprocating with motor driver.
2. One (1) Air Compressor (outlet capacity 43 Nm3/hr), oil free reciprocating with motor driver.

The compressor packages are equipped with LCP, local MCC and local Junction Boxes. The control for the compressors will be done with by Airpack. The UCP will be connected through Modbus.

The compressor cooling will be cooled by an open cooling water system.

4. HSE

Standard safety precautions have to be taken since we are working with pressurised air.

- Proper PPE has to be worn when working / testing the package
- All visitors for the FAT will be instructed before the FAT, about Airpack safety precautions, by Airpack Safety movie.
- All visitors will be asked to sign a disclaimer to be able to enter the hazardous area during the test.
- The test area is cordoned off to make sure non-authorized personnel does not enter this area.

5. FAT Kick off meeting

Before starting the FAT there will be a short kick off meeting, where Airpack will explain the safety rules and regulations as well as what activities and planning will be performed during the FAT.

Kick-Off Meeting (KOM) Agenda.

i. Introduction/Sign in (along with the name, role/designation)
ii. HSE Induction
iii. FAT organization, roles and responsibilities of the personnel involved.
iv. Briefing on duration and sequence of tests planned, timing etc.

Also proper PPE will be distributed as required.

6. Roles and responsibilities

The project manager is responsible for the complete FAT. The project manager will arrange the persons who are required for each part of the FAT.

A qualified AIRPACK Technician who is familiar with the operational parameters of the Package will perform all FAT tasks

6.1. Problem resolution

If there are any problems during the FAT, they will be rectified immediately if possible, if not possible they will be recorded in the FAT punch list and resolved before shipment /commissioning of the package.

Please find attachment 1: Punch list format.

7. Test Instruments

The following test instruments will be used during the FAT, all instruments will have a valid calibration certificate which will be supplied as part of the FAT test results for checking and signing.

- Paint thickness meter
- Sound level meter
- Ambient pressure / temperature meter
- Multi meter (voltage check)
- Etc.

8. Utilities

The utilities that are available during FAT are:

- Power: 400V / 50Hz / 3ph and 230V / 50Hz / 1ph
- Instrument Air: 43 - 90 Nm^3/hr, 7.0 - 9.0 bar(g), 5 °C - 55 °C

9. Test procedure

Test may not be done in below order; it is subject to availability of personnel and equipment.

9.1. Mechanical checks

The following will be tested / checked and recorded as part of the FAT:

Quality

1 Verify all equipment are installed in accordance with approved P & ID and GAD.
2 Visual inspection of the complete package for quality.
3 Verify piping, tubing location, orientation in accordance with approved GA Drawing.

P&ID review

1 Verify all components are installed as per the GA Drawing.
2 Check that all components are tagged according to the P&ID.
3 Check that the location is of the components is as per the GAD.

Dimensions

1 Dimensional check of the complete package for compliance to approved GA Drawing.
2 Verification and dimensional check of Tie-in Point, lifting points (If any).
3 Verification and dimensional check of foundation holes.

Painting

1 Check the overall paint for damages and overall quality.
2 Randomly check the thickness as per the approved paint procedure.
3 Check the paint color as per the paint procedure.

Control Panel

1 Check for any loose connection in the control panel.
2 Verify all control panel BOM, GA, wiring, I/O etc., matches approved drawings.
3 Check the installation and type of cable glands.
4 Check the installation of the cable trays.
5 Check the cable type.

Instruments

1 Check for any loose connection of cables or wires in the instruments.
2 Check the installation of the instruments as per approved drawings.
3 Check if all instruments are tagged.
4 Check the quantity of the instruments.

All checks are mentioned in attachment 2: Equipment checklist

9.2. Functional test control system

A functional test will be executed on local control panels.

The functional test will be performed as per attachment 3: Functional test results

Following items are functionally tested / checked:

- Power up checks
- Grounding check (instruments will be earthed externally)
- I/O checks
- Alarms (10% random alarms are individually dry tested)
- Trips (10% random trips are individually dry tested)
- Check functionality of panel displays (HMI)
- Cause and effect test of the package
- Operation check (start, stop, etc.)

9.3. Performance test (two hours)

Test set-up for the package is as follows:

- The power from the package will come from internal power supply
- 400V / 50Hz / 3ph and 230V / 50Hz / 1ph
- Program is on.

The following measurements will be taken during the performance test.

- Sound level at 1 metre distance from skid (max. 85 dB(A)).
- Instruments will be monitored.
- Refer to Attachment 1 for an example of the performance test results sheet, which will be filled in during FAT.

All in house instruments required / used during the test will have recent calibration certificated, which will be attached to the FAT test report.

The FAT recordings can be found in attachment 4: Performance test results

9.4. Noise level measurement

Noise test will be done during the performance test. Measuring points will be defined by a distance of 1 metre from the package and measured round the package. Final measuring point will be the same as start measure point. This is for checking correct functioning of the noise level meter.

Noise level shall not exceed 85 dB(A) for complete package at 1 metre distance (with package test blow off muffler closed).

The measurement will be recorded in attachment 5: Noise test results.

9.5. Vibration measurement

Vibration measurement will be done with job vibration transmitter.

The vibration level should not exceed 8 mm/s.

Punch List (Nitrogen) Compressor Package

Project: 17811-GEN

Revision	**0**	
Dry Test		
Inhouse Test		
FAT		
I-FAT		
F. Inspection		
Shipment		
Commissioning		

Item	Description	Point raised by	Action by	Completion before	Closed [date] [name]
001					
002					
003					
004					
005					
006					
007					
008					
009					
010					
011					
012					
013					
014					
015					
016					
017					
018					
019					
020					
021					
022					
023					
024					
025					
026					

FAT TEST PROCEDURE

Equipment	Nitrogen Compressor Package
Customer	BUPC
Serial number	T-2020-00753
Project name	Bushehr MEG Plant Project
Airpack reference number	17811-COM
Date	DD/MM/YYYY
Revision	0
Document number	17811-14
Handled by	KP
Number of pages	01 / 02

INSPECTION	DOCUMENT	COMPLETED	REMARKS
Quality			
1. Installation of main equipment	GAD / PID		
2. Visual inspection of overall quality	GAD / PID		
3. Piping, tubing location / orientation	GAD / PID		
P&ID review			
1. Component check	P&ID		
2. Tagging of all components	P&ID		
3. Component location	P&ID		
Dimensions			
1. Overal skid dimensions	GAD		
2. Tie-in point dimensions	GAD		
3. Foundation bolt holes	GAD		
Painting			
1. Overal Paint quality	Paint procedure		
2. Painf DFT measurement	Paint procedure		
3. Paint color	Paint procedure		
Control Panel			
1. Loose connections	Wiring diagram / Panel lay-out		
2. BOM	Wiring diagram / Panel lay-out		
3. Cable glands	Wiring diagram / Panel lay-out		
4. Cable trays	Wiring diagram / Panel lay-out		
5. Cable type	Wiring diagram / Panel lay-out		
Instruments			
1. Loose connections	Wiring diagram		
2. Installation	P&ID		
3. Tagging	P&ID		
4. Quantity	P&ID		

Airpack Test Engineer	Client Inspector

Notes:

FAT TEST PROCEDURE

Equipment	Air Compressor Package
Customer	BUPC
Serial number	T-2020-00754
Project name	Bushehr MEG Plant Project
Airpack reference number	17811-COM
Date	DD/MM/YYYY
Revision	0
Document number	17811-14
Handled by	KP
Number of pages	02 / 02

INSPECTION	DOCUMENT	COMPLETED	REMARKS
Quality			
1. Installation of main equipment	GAD / PID		
2. Visual inspection of overall quality	GAD / PID		
3. Piping, tubing location / orientation	GAD / PID		
P&ID review			
1. Component check	P&ID		
2. Tagging of all components	P&ID		
3. Component location	P&ID		
Dimensions			
1. Overal skid dimensions	GAD		
2. Tie-in point dimensions	GAD		
3. Foundation bolt holes	GAD		
Painting			
1. Overal Paint quality	Paint procedure		
2. Painf DFT measurement	Paint procedure		
3. Paint color	Paint procedure		
Control Panel			
1. Loose connections	Wiring diagram / Panel lay-out		
2. BOM	Wiring diagram / Panel lay-out		
3. Cable glands	Wiring diagram / Panel lay-out		
4. Cable trays	Wiring diagram / Panel lay-out		
5. Cable type	Wiring diagram / Panel lay-out		
Instruments			
1. Loose connections	Wiring diagram		
2. Installation	P&ID		
3. Tagging	P&ID		
4. Quantity	P&ID		

Airpack Test Engineer	Client Inspector

Notes:

FAT TEST PROCEDURE

Equipment	Nitrogen Compressor Package
Customer	BUPC
Serial number	T-2020-00753
Project name	Bushehr MEG Plant Project
Airpack reference number	17811-COM
Date	DD/MM/YYYY
Revision	0
Document number	17811-14
Handled by	KP
Number of pages	01 / 02

INSPECTION	DOCUMENT	COMPLETED	REMARKS
Power up check	Wiring diagram		
Grounding check	Wiring diagram		
I/O check	Wiring diagram		
Alarm test of 10%	Control Philosophy		
Trip test of 10 %	Control Philosophy		
HMI functionality check	Control Philosophy		
Cause and effect	Cause & Effect Chart		
Operational check	Control Philosophy		

Airpack Test Engineer	Client Inspector

Notes:

FAT TEST PROCEDURE

Equipment	Air Compressor Package
Customer	BUPC
Serial number	T-2020-00754
Project name	Bushehr MEG Plant Project
Airpack reference number	17811-COM
Date	DD/MM/YYYY
Revision	0
Document number	17811-14
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INSPECTION	DOCUMENT	COMPLETED	REMARKS
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Airpack Test Engineer	Client Inspector

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Equipment	Nitrogen Compressor Package
Customer	BUPC
Serial number	T-2020-00753
Project name	Bushehr MEG Plant Project
Airpack reference number	17811-COM
Date	DD/MM/YYYY
Revision	0
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Performance Test Results

NITROGEN COMPRESSOR PACKAGE

	00:00	00:15	00:30	00:45	01:00	01:15	01:30	01:45	02:00	UNIT
PDG-10001 DIFFERENTIAL PRESSURE INLET Y-STRAINER	START									mbar
PG-10002 PRESSURE GAUGE INLET										bar(g)
PIT-10003 PRESSURE TRANSMITTER INLET										bar(g)
TIT-10001 TEMPERATURE TRANSMITTER INLET										ºC
TIT-10002 TEMPERATURE TRANSMITTER OUTLET										ºC
PG-10005 PRESSURE GAUGE OUTLET										bar(g)
PIT-10007 PRESSURE TRANSMITTER OUTLET										bar(g)
PG-10006 PRESSURE GAUGE INLET COOLING WATER										bar(g)
TG-10004 TEMPERATURE GAUGE INLET COOLING WATER										ºC
TG-10003 TEMPERATURE GAUGE OUTLET COOLING WATER										ºC
FT-10001 FLOW TRANSMITTER OUTLET COOLING WATER										Nm3/hr
VT-10001 VIBRATION TRANSMITTER COMPRESSOR										mm/s

Running test starting time:		
Humidity:		R.H.%
Cycle time of dryer:		Minute
Filling time of dryer:		Minute
Ambient temperature:		°C
Ambient pressure:		hPa

Airpack Test Engineer	Client Inspector

Notes:

FAT TEST PROCEDURE

Equipment	Air Compressor Package
Customer	BUPC
Serial number	T-2020-00754
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Date	DD/MM/YYYY
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Document number	17811-14
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Number of pages	02 / 02

Performance Test Results

NITROGEN COMPRESSOR PACKAGE

	00:00	00:15	00:30	00:45	01:00	01:15	01:30	01:45	02:00	UNIT
PDG-70001 DIFFERENTIAL PRESSURE INLET Y-STRAINER	START									mbar
PG-70002 PRESSURE GAUGE INLET										bar(g)
PIT-70003 PRESSURE TRANSMITTER INLET										bar(g)
TIT-70001 TEMPERATURE TRANSMITTER INLET										ºC
TIT-70002 TEMPERATURE TRANSMITTER OUTLET										ºC
PG-70005 PRESSURE GAUGE OUTLET										bar(g)
PIT-70007 PRESSURE TRANSMITTER OUTLET										bar(g)
PG-70006 PRESSURE GAUGE INLET COOLING WATER										bar(g)
TG-70004 TEMPERATURE GAUGE INLET COOLING WATER										ºC
TG-70003 TEMPERATURE GAUGE OUTLET COOLING WATER										ºC
FT-70001 FLOW TRANSMITTER OUTLET COOLING WATER										Nm3/hr
VT-70001 VIBRATION TRANSMITTER COMPRESSOR										mm/s

Running test starting time:		
Humidity:		R.H.%
Cycle time of dryer:		Minute
Filling time of dryer:		Minute
Ambient temperature:		°C
Ambient pressure:		hPa

Airpack Test Engineer	Client Inspector

Notes:

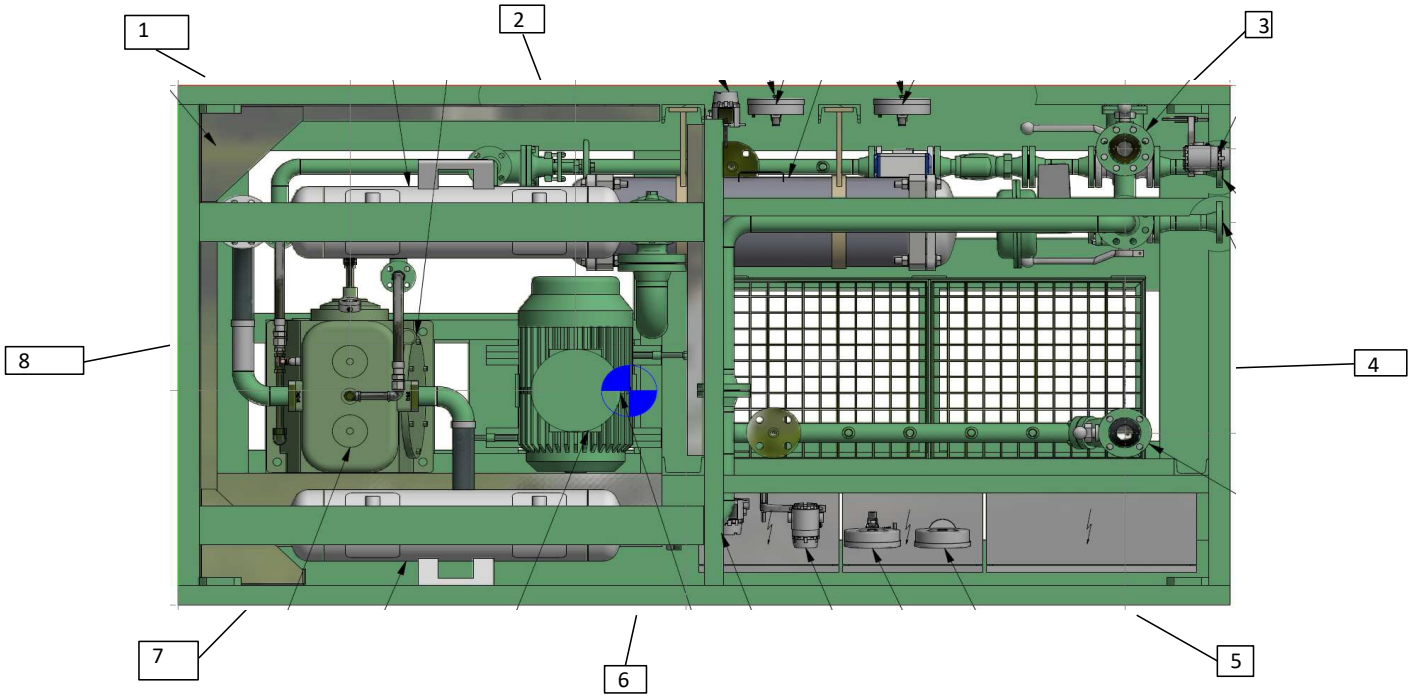
Bushehr MEG Plant Project

Document n° : 17811-14
Revision : 0

NOISE LEVEL

Unit :	**Nitrogen Compressor Package**	**Client:**	BUPC
Service :	**Compressed Nitrogen**	**Contractor:**	FGS
Supplier :	**Airpack Nederland BV**	**Agent:**	HSE Group
Manufacturer :	**Airpack Nederland BV**		
Serial No. :	**T-2020-00753**		

Supplier to Complete
Expected Noise Level Data



Noise test has been performed during performance test:

Procedure:
Measure point will be defined by a distance of 1 metre from the package and 1,5 metre above the ground level to measured round the package. Final measure points will be the same as start measure points. This is for checking correct functioning of the noise level meter. Noise shall not exceed 85 dB(A) for complete package. Noise meter calibration certificate is available during test

Points	Unit	Noise Estimated	Noise measured	Average of anti logs	Noise level (Logarithmic Avg)	Noise level (Arithmetic Avg)
P1	dB(A)	85				
P2	dB(A)	84				
P3	dB(A)	83				
P4	dB(A)	83				
P5	dB(A)	83				
P6	dB(A)	84				
P7	dB(A)	85				
P8	dB(A)	85				

Surrounding Noise measured (dB(A)) : 75

Noise level (After correction(If required) as per 5.3 of ISO 2151):

Correction Factor		
Level increase due to	Value to be subtracted from measured	-2
5	2	
6 to 9	1	

Test Result:

Tested By :

Date:

NOTE:

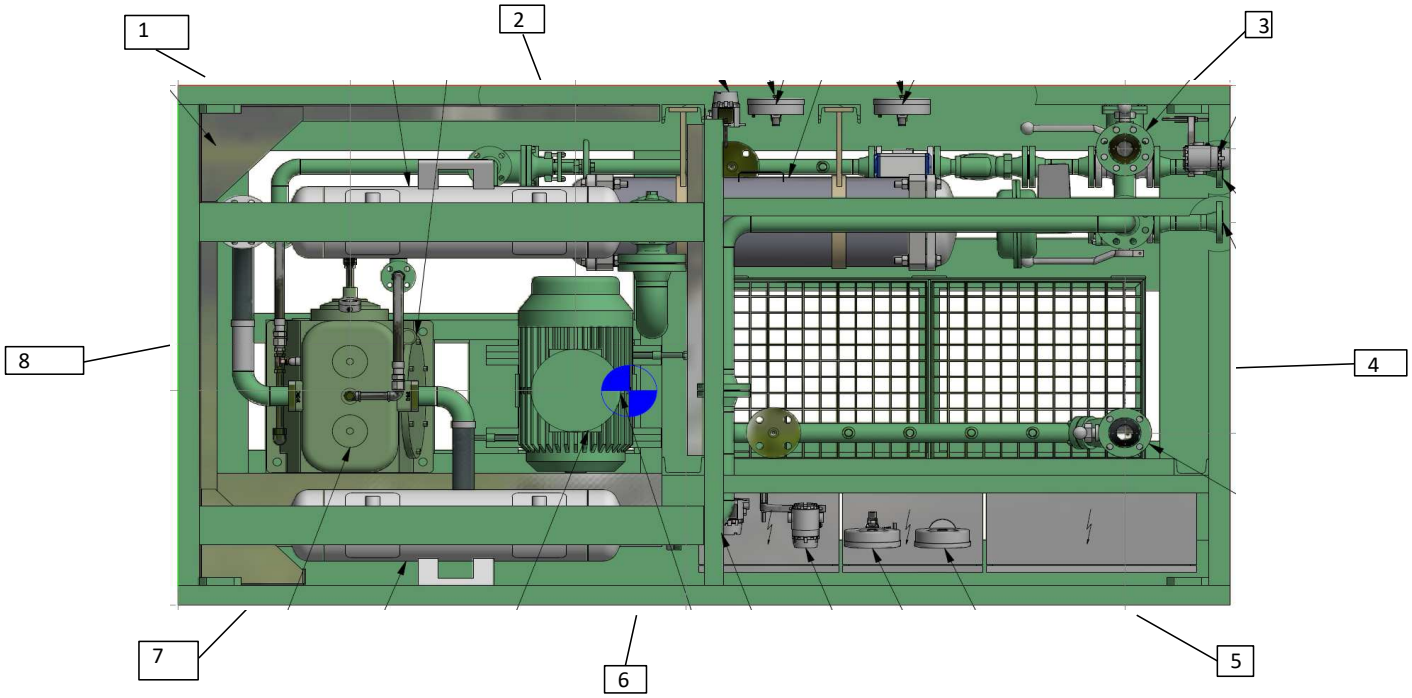
Bushehr MEG Plant Project

Document n° : 17811-14
Revision : 0

NOISE LEVEL

Unit :	**Air Compressor Package**	**Client:**	BUPC
Service :	**Compressed Air**	**Contractor:**	FGS
Supplier :	**Airpack Nederland BV**	**Agent:**	HSE Group
Manufacturer :	**Airpack Nederland BV**		
Serial No. :	**T-2020-00754**		

Supplier to Complete
Expected Noise Level Data



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P1	dB(A)	85				
P2	dB(A)	84				
P3	dB(A)	83				
P4	dB(A)	83				
P5	dB(A)	83				
P6	dB(A)	84				
P7	dB(A)	85				
P8	dB(A)	85				

Surrounding Noise measured (dB(A)) : 75

Noise level (After correction(If required) as per 5.3 of ISO 2151):

Correction Factor		
Level increase due to	Value to be subtracted from measured	-2
5	2	
6 to 9	1	

Test Result:

Tested By :

Date:

NOTE: