PERFORMANCE QUALIFICATION PROTOCOL FOR COMPRESSED AIR GENERATION AND DISTRIBUTION SYSTEM

EQUIPMENT ID. No.	
LOCATION	**Utility Block**
DATE OF QUALIFICATION	
SUPERSEDES PROTOCOL No.	**NIL**

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1.0 PROTOCOL APPROVAL:

INITIATED BY:

DESIGNATION	NAME	SIGNATURE	DATE
OFFICER/EXECUTIVE (QUALITY ASSURANCE)			

REVIEWED BY:

DESIGNATION	NAME	SIGNATURE	DATE
HEAD (PRODUCTION)			
HEAD (QUALITY CONTROL)			
HEAD (ENGINEERING)			

APPROVED BY:

DESIGNATION	NAME	SIGNATURE	DATE
HEAD (QUALITY ASSURANCE)			

2.0 OBJECTIVE:

- To provide documented evidence that the Compressed Air System is performing consistently, repeatedly and reproducibly within its established operating range and the results of all the test parameters meet the pre-defined acceptance criteria.
- To confirm the suitability of the Standard Operating Procedures for all routine activities associated with the system.

3.0 SCOPE:

- The Protocol covers all aspects of Performance Qualification for the **Compressed Air System (Make- Chicago Pneumatics**) installed in the Utility Block at ……..
- This Protocol will define the methods and documentation used to qualify the Compressed Air System for PQ.

4.0 RESPONSIBILITY:

The Validation Group, comprising of a representative from each of the following departments, shall be responsible for the overall compliance of this Protocol cum Report:

DEPARTMENTS	RESPONSIBILITIES
Quality Assurance	• Preparation, Authorization, Approval and Compilation of the Performance Qualification. • Co-ordination with Quality Control, Production and Engineering to carryout Performance Qualification Activity. • Monitoring of Performance Qualification.
Production	• Review of Protocol. • To co-ordinate and support Performance Qualification Activity.
Quality Control	• Review of Protocol. • Analytical Support (Microbiological Testing/Analysis)
Engineering	• Reviewing of qualification protocol for correctness, completeness and technical excellence • Responsible for trouble shooting (if occurred during execution). • Maintenance & preventive maintenance as per schedule.

5.0 EQUIPMENT DETAILS:

Equipment Name	Compressed Air System
Equipment	
Manufacturer's Name	Chicago Pneumatics
Model	GMP Model
Supplier's Name	Chicago Pneumatics
Location of Installation	Utility Block

6.0 SYSTEM DESCRIPTION:

Air compressor unit has an air unit system which is responsible for delivering quality compressed air at the outlet. It starts from the suction filter of the compressor and ends at the final service valve of the unit. Air compressor provides a filter of superior grade at the suction of the compressor to avoid any ingress of solid particles. The compressor cylinder, during suction stroke, aspires atmospheric air through the filer and compresses it to the delivery pressure.

The delivery pressure is achieved by compressing the air in stages. Between successive stages a highly efficient heat exchanger is provided to remove the heat of compression. Air, before passing to the next stage is cooled to near about atmospheric temperature in the heat exchanger. This helps in reducing the final air discharge temperature as well as the power consumption of the compressor.

Sterilizing grade 0.2 micron hydrophobic filter shall be fixed at critical user points to deliver sterilized compressed air supply, wherever required and filters with sufficient particulate and microbial retention efficiency may also be installed at the user points to improve the purity of supplied air. The oil-free compressed air system consists of an oil-free compressor, storage tank and refrigerant dryer and distribution system.

Air compressor is double acting horizontal cross head type, it consists two cylinders each cylinder is fitted with suction and delivery valves. The suction air filter is connected at the middle of cylinders, so that air can enter, at both ends of the piston during the forward and backward strokes. Quantity of air sucked at the front side is compressed up to approx 2 Kg/cm^2 pressure.

After compression, the air from the first stage cylinder, passes through the delivery valves to the inter cooler provided between the first and second stage. There it is cooled approx 30 ± 5^0C temperature and is sucked by the 2nd stage through the suction valves. In the next stage the compressed air up to the 8.0 ± 0.5 Kg/cm^2 pressure enters to the delivery header connected to the cooler and finally to the receiver.

Fig. 01: Key Components of Compressed Air System

Fig. 02: Key Components of Compressed Air System

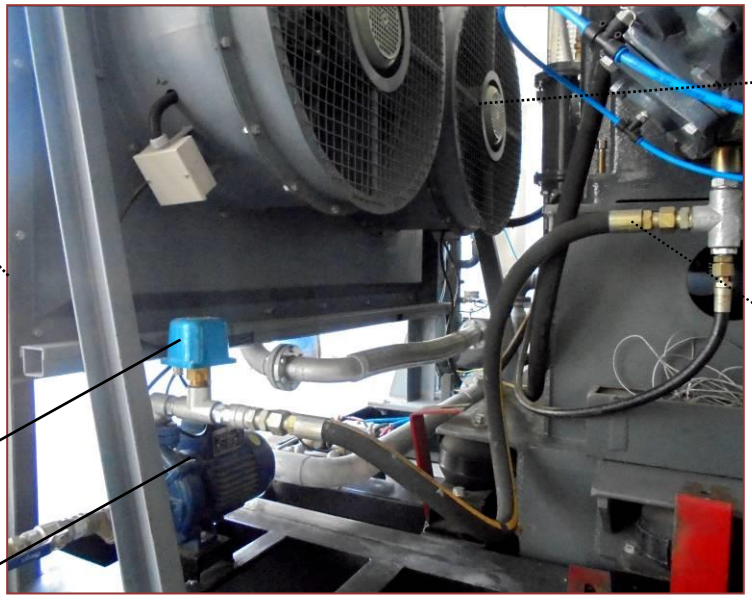


Fig. 03: Key Components of Compressed Air System

7.0 SITE OF STUDY:

Utility Block

8.0 FREQUENCY OF QUALIFICATION:

- Once in every two years time period.
- After any major breakdown or after major modification.
- After Change of Location.

9.0 PRE – QUALIFICATION REQUIREMENTS:

The below mentioned activities should be completed prior to commencing the performance qualification activity:

- Completion of design qualification activity
- Completion of installation qualification activity
- Completion of operational qualification activity
- Preparation of SOP for Operating & Cleaning of Compressed Air System.

10.0 TESTS AND CHECKS:

A. Document Verification.

B. Verification of Calibration of test instruments.

C. Performance Qualification Testing:

Performance Qualification study shall be carried out using following tests:

- Determination of Oil Content in Compressed Air
- Determination of Moisture Content in Compressed Air
- Viable Particle Count
- System Supply Reliability Test

List critical and non-critical user point all mentioned in the annexure-I of this protocol. Testing for performance qualification activity shall be performed on the critical & non-critical compressed air supply points which are in use as applicable and all new introduced supply points shall be enclosed as addendum to the PQ report.

Acceptance Criteria:

- DQ, IQ & OQ activity should be completed and executed, approved qualification report should be available prior to commencing the performance qualification activity.
- Calibration of all components of system should be completed prior to commencing the performance qualification activity.
- Compressed air should meet the specifications for oil content, water content, viable particle count and system supply reliability test.

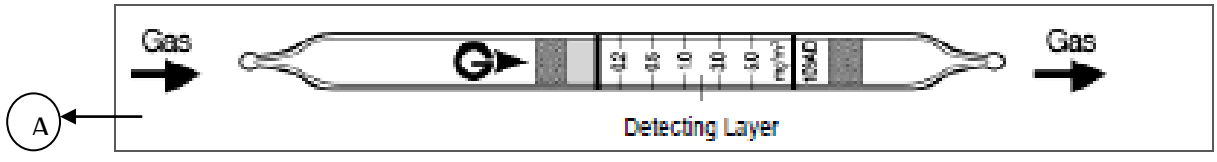
10.1 Determination of Oil Content in Compressed Air:

Objective:

The objective of this test is to ensure that, the compressed air that is used for various processes is free from oil contaminants or such contaminants is removed up to acceptable level from compressed air during air drying and filtration stage.

Principle:

The test is performed to determine the oil content in the compressed air. Test is carried out using the Gastec tubes (Oil Mist Airtec Tubes No. 109AD).



Specifications for Oil Mist (Mineral Oils) Airtec Tubes No. 109AD are as follows:

S. No.	Parameter	Specification
1.	Measuring Range	0.2 to 5.0 mg/m^3
2.	Sampling Volume	20000 ml
3.	Sampling Rate	1 Liter per minute
4.	Sampling Time	20 minutes
5.	Colour Change	Pale Red ⟶ Pale Blue
6.	Reaction Principle	**Oil Mist + Cr^{6+} (Pale Red Color) ⟶ Cr^{3+} (Pale Blue Color)**

Measuring Procedure:

1. Attach a pressure reducer with gauze and flow meter to a cylinder, compressor or compressed air line and adjust the pressure between 2.0 – 2.5 kg/cm^2 for supply of compressed air to the flow meter assembly.
2. Adjust the flow rate by setting knob of flow meter assembly to set the flow rate of 1000 ml per minute.
3. Stop supply of compressed air to the test unit.
4. Break tips of Gastec tube using tube tip breaker.

5. Attach the Gastec Tube to the assembly keeping the arrow showing the flow direction of air towards the flow meter side (Side A shown in the picture).
6. Start supply of compressed air to the test assembly.
7. If required adjust the flow rate by setting knob of flow meter.
8. Record the time.
9. On completion of 20 minutes stop supply of compressed air to test assembly.
10. Record the reading for oil content shown on the scale by pale blue color.
11. Detach Gastec tube from the test assembly.

Acceptance Criteria:

Oil Content should be below 1 mg/m^3.

Frequency:

Initially from Critical User Points.

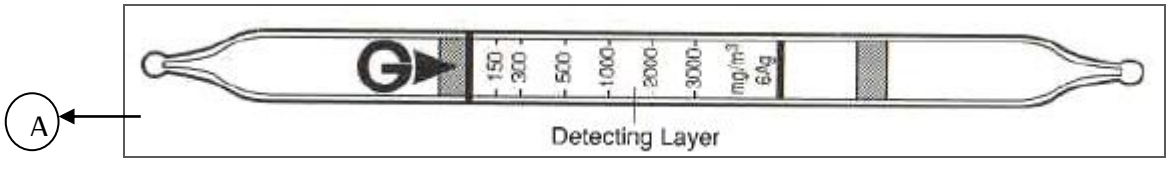
10.2 Determination of Water Vapor Content in Compressed Air:

Objective:

The objective of this test is to ensure that, the compressed air that is used for various processes is free from water vapor or water vapor is removed up to acceptable level from compressed air during air drying and filtration stage.

Principle:

The test is performed to determine the moisture content in the compressed air. Test is carried out using the Gastec tubes (Water Vapour Airtec Tubes No. 6Ag).



Specifications for Water Vapour Airtec Tubes No. 6Ag are as follows:

S. No.	Parameter	Specification
1.	Measuring Range	150 to 3000 mg/m^3
2.	Sampling Volume	300 ml
3.	Sampling Rate	300 ml per minute

4.	Sampling Time	1 minutes
5.	Colour Change	Green ⟶ Purple
6.	Reaction Principle	**H_2O + $Mg(ClO_4)_2$ (Green Color) ⟶ $Mg(ClO_4)_2$ (Purple Color)**

Measuring Procedure:

1. Attach a pressure reducer with gauze and flow meter to a cylinder, compressor or compressed air line and adjust the pressure between 2.0 – 2.5 kg/cm^2 for supply of compressed air to the flow meter assembly.
2. Adjust the flow rate by setting knob of flow meter assembly to set the flow rate of 300 ml per minute.
3. Stop supply of compressed air to the test unit.
4. Break tips of Gastec tube using tube tip breaker.
5. Attach the Gastec Tube to the assembly keeping the arrow showing the flow direction of air towards the flow meter side (Side A shown in the picture).
6. Start supply of compressed air to the test assembly.
7. If required adjust the flow rate by setting knob of flow meter.
8. Record the time.
9. On completion of 1 minute stop supply of compressed air to test assembly.
10. Record the reading for moisture content shown on the scale by purple color.
11. Detach Gastec tube from the test assembly.

Acceptance Criteria:

Water Vapor Content should be below 500 mg/m^3.

Frequency:

Initially from Critical User Points.

10.3 Viable Particle Count:

Objective:

Objective of this test is to ensure that, the Viable Particle Count of compressed air that is used in various user points is within the permissible limit of Not More Than 100 CFU/1000 ml of air.

Methodology:

- Connect compressed air test assembly to the compressed air supply point.
- Adjust knob of assembly to set pressure of 2.0 kg/cm^2.
- Adjust knob of flow regulator to set flow rate of 500 ml per minute.
- Stop supply of compressed air to the unit.
- Remove cotton plug of flask containing nutrient media and immerge tube of assembly in the media.
- Start supply of compressed air to the unit to start purging of compressed air in the nutrient media.
- Perform purging of compressed air through nutrient media for 2 minutes.
- On completion of purging time stop supply of compressed air and close the flask containing nutrient media with cotton plug and seal by wrapping with aluminum foil.

Acceptance Criteria:

Less than 100 cfu / 1000 ml of air.

Frequency:

5 times from each Critical User Points on different days.

10.4 System Supply Reliability Test:

Objective:

The objective of this test is to ensure that, the pressure of compressed air at individual user point is available as per the specified limit mentioned in the design specification.

Methodology:

Determine the compressed air pressure at individual user points.

Acceptance Criteria:

0.2 to 6.5 kg/cm^2

Frequency:

5 times from all User Points on different days.

11.0 REFERENCES:

The Principle Reference is the following:

- Validation Master Plan.
- Schedule-M – "Good Manufacturing Practices and Requirements of Premises, Plant and Equipment for Pharmaceutical Products."
- WHO Essential Drugs and Medicines Policy, QA of Pharmaceuticals, Vol-2 – Good Manufacturing Practices and Inspection.

The following references are used for addition guidance

- FDA/ISPE Baseline Pharmaceutical Engineering Guide-Volume 5:- Commissioning and Qualification Guide, First Edition/March 2001.
- EU Guide to Good Manufacturing Practice, Part 4, 1997.
- European Commission's working party on control of medicines and inspections document, Validation Master Plan, Design Qualification, Installation & Operational Qualification, Non Sterile Process Validation, Cleaning Validation, October 1999.

12.0 DOCUMENTS TO BE ATTACHED:

- Operation And Maintenance Manual
- Copy of Draft SOPs
- Any Other Relevant Documents

13.0 NON – COMPLIANCE:

All the Non-compliances of procedure, specifications, and sampling, analysis and documentation activities shall be monitored & recorded.

14.0 DEVIATION FROM PRE-DEFINED SPECIFICATION, IF ANY:

- In case of any deviation observed during PQ, inform to Head QA for necessary action.
- Document the deviation detail in observed deviation section.
- The Head QA will study the impact of deviation. If deviation is acceptable and it does not have an Impact on operation as well as on performance of the machine & prepare final conclusion.

15.0 CHANGE CONTROL, IF ANY:

- If any change control is required during PQ, inform to Head QA for necessary action.
- Document the details observed.
- The Head QA will study the impact of change. If change is acceptable and it does not have an Impact on operation as well as on performance of the machine & prepare final conclusion.

16.0 ABBREVIATIONS:

Sr.	:	Senior
Asst.	:	Assistant
No.	:	Number
WHO	:	World Health Organization
FDA	:	Food and Drug Administration
CFR	:	Code of Federal Regulations
cGMP	:	Current Good Manufacturing Practices
QA	:	Quality Assurance
CFU	:	Colony Forming Unit

ANNEXURE-I

LIST OF CRITICAL AND NON-CRITICAL USER POINTS

S.No.	Area / Location	Sampling Points	ID. No.	Critical / Non Critical
1.	**Granulation 01**			
	Paste room	01		Non-critical
	FBD	01		Non-critical
	FBD	01		Non-critical
	RMG	01		Critical
2.	**Granulation 02**			
	Paste room	01		Non-critical
	FBD	01		Non-critical
	RMG	01		Critical
3.	**Granulation 03**			
	Paste room	01		Non-critical
	FBD	01		Non-critical
	RMG	01		Critical
4.	**Granulation 05**			
	Paste room	01		Non-critical
	FBD	01		Non-critical
	RMG	01		Critical
5.	**Granulation 06**			
	Paste room	01		Non-critical
	FBD	01		Non-critical
	FBD	01		Non-critical
	RMG	01		Critical
	Octagonal Blender	01		Non-critical
6.	**Granulation 07**			
	Paste room	01		Non-critical
	FBD	01		Non-critical
	FBD	01		Non-critical

S.No.	Area / Location	Sampling Points	ID. No.	Critical / Non Critical
	RMG	01		Critical
	Octagonal Blender	01		Non-critical
7.	**Granulation 10**			
	FBD	01		Non-critical
8.	**Compression-01**	01		Non-critical
9.	**Compression-02**	01		Non-critical
10.	**Compression-03**	01		Non-critical
11.	**Compression-04**	01		Non-critical
12.	**Compression-05**	01		Non-critical
13.	**Compression-06**	01		Non-critical
14.	**Compression-07**	01		Non-critical
15.	**Compression-08**	01		Non-critical
16.	**Compression-09**	01		Non-critical
17.	**Compression-10**	01		Non-critical
18.	**Compression-11**	01		Non-critical
19.	**Compression-12**	01		Non-critical
20.	**Compression-13**	01		Non-critical
21.	**Compression-14**	01		Non-critical
22.	**Compression 15**	01		Non-critical
23.	**Compression 16**	01		Non-critical
24.	**Compression 17**	01		Non-critical
25.	**Compression 18**	01		Non-critical
26.	**Coating 01**	01		Critical
27.	**Coating 02**	01		Critical
28.	**Coating 03**	01		Critical
29.	**Coating 04**	01		Critical
30.	**Coating 05**	01		Critical
31.	**Coating 06**	01		Critical

S.No.	Area / Location	Sampling Points	ID. No.	Critical / Non Critical
32.	Coating 07	01		Critical
33.	Coating 08	01		Critical
34.	Coating 09	01		Critical
35.	Coating 10	01		Critical
36.	Coating 11	01		Critical
37.	Coating 12	01		Critical
38.	Coating 13	01		Critical
39.	Capsule filling 01	01		Critical
40.	Capsule filling 02	01		Critical
41.	Capsule filling 03	01		Critical
42.	Soft Gel Section	01		Critical
43.	Soft Gel Section	01		Critical
44.	Soft Gel Section	01		Critical
45.	Soft Gel Section	01		Critical
46.	Packing Line 01 (BLM)	01		Critical
47.	Packing Line 02 (BLM)	01		Critical
48.	Packing Line 03 (ABB)	01		Critical
49.	Packing Line 04 (BLM)	01		Critical
50.	Packing Line 05 (BLM)	01		Critical
51.	Packing Line 06 (ABB)	01		Critical
52.	Packing Line 07 (BLM)	01		Critical
53.	Packing Line 08 (BLM)	01		Critical
54.	Packing Line 09 (ABB)	01		Critical
55.	Packing Line 10 (BLM)	01		Critical
56.	Packing Line 11 (BLM)	01		Critical
57.	Packing Line 12 (STP)	01		Critical
58.	Packing Line 13 (BLM)	01		Critical
59.	Packing Line 14 (STP)	01		Critical

S.No.	Area / Location	Sampling Points	ID. No.	Critical / Non Critical
60.	Packing Line 15 (STP)	01		Critical
61.	Packing Line 16 (STP)	01		Critical
62.	Packing Line 17 (ABB)	01		Critical
63.	Packing Line 18 (ABB)	01		Critical
64.	Packing Line 19 (STP)	01		Critical
65.	Packing Line 20 (STP)	01		Critical
66.	Packing Line 21 (BLM)	01		Critical
67.	Packing Line 22 (BLM)	01		Critical
68.	Packing Line 23 (BLM)	01		Critical
69.	Packing Line 24 (FFS)	01		Critical
70.	Packing Line 25 (PFM)	01		Critical
71.	Packing Line 26 (BLM)	01		Critical
72.	Packing Line 27 (BLM)	01		Critical
73.	RM Liquid	01		Critical
74.	Filter Cleaning	01		Non-critical
75.	Softgel section capsule polishing	01		critical
76.	Water System	01		Non-critical
	Water System	01		Non-critical

Note:

- **Critical Points: Is defined as point where the compressed air being supplied by the point is carried to direct contact with the product and has impact on the product.**
- **Non-Critical Points: Is defined as point where the compressed air being supplied by the point does not come in contact with the product but used in the operating system to run the equipment.**
- **Identification Tags for compressed air supply points of RMG, FBD & Auto Coater shall be placed on the compressed air distribution control panel of equipments located at the service floor and sampling shall be performed from the point installed in the equipment specially where the air is coming in direct contact with the product.**