



PRODUCT STANDARD
TURBINES AND COMPRESSORS
HYDERABAD

TC-6-2625
REV No.: **00**
PAGE 1 OF 7

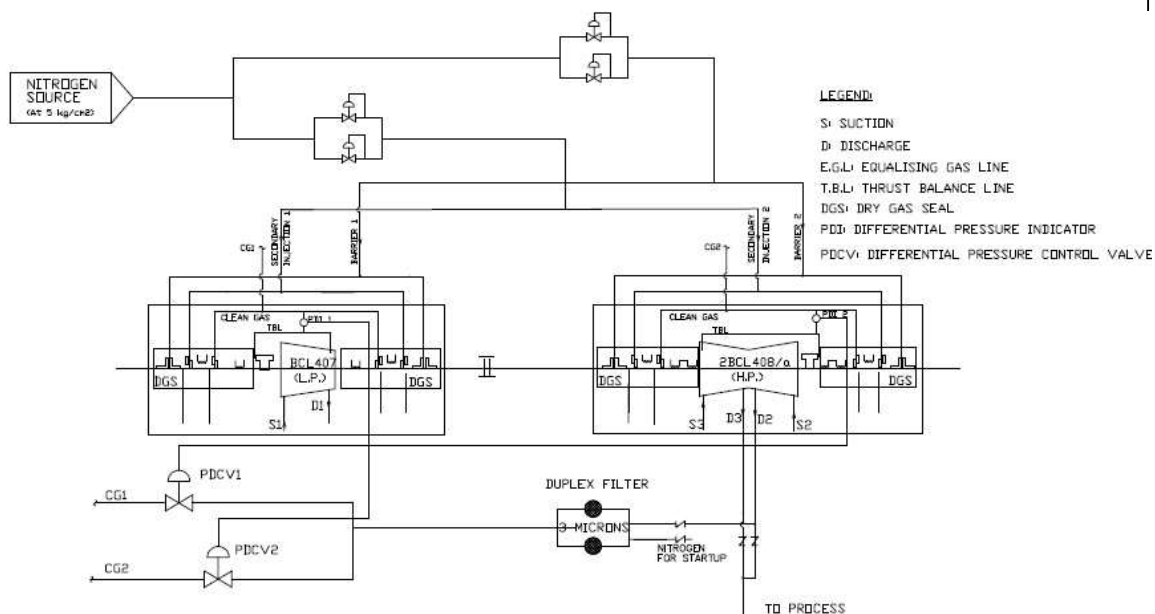
JOB SPECIFICATION OF DRY GAS SEALS

PROJECT: M/s APL SYN GAS (BCL 407+ ST+ 2BCL 408/A)

1. GENERAL SPECIFICATION:

For general details of dry gas seals, please refer General Specification No.TC52357
For Seal Shaft and Housing Dimensions, please refer Specification No.TC52508

2. SCHEMATIC OF GAS SEAL SYSTEM



For a detailed scheme, refer to Seal gas P&ID as provided in Dry Gas Seal skid specification

Scope of supply of supporting seal gas system (along with filter skid) is covered under a separate specification vide TC55450

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Ref. Doc.

Rev. No.	Revisions	Prepared	Approved	Date
01	Refer to record of revisions	RNR	YVRL	09.05.18



PRODUCT STANDARD
TURBINES AND COMPRESSORS
HYDERABAD

TC-6-2625REV No.: **00**

PAGE 2 OF 7

3. SEAL PROCUREMENT DETAILS**3.1 DRY GAS SEAL CONFIGURATION**

SINGLE [] DOUBLE [] TANDEM [X] TRIPLE []

3.2 DRY GAS SEAL TYPE:

UNIDIRECTIONAL [] BIDIRECTIONAL [X]

3.3 INTERMEDIATE LABYRINTH: Yes / No**3.4 BARRIER SEAL:** CARBON RING TERTIARY [X] LABYRINTH SEAL []**3.5 SEAL CODE DESCRIPTION:**

Var	Description	BHEL Matl code
01	Tandem type Bi directional Dry Gas Seal (Φ97) with Barrier seal	TC9762625013
02	DGS Assy/Dis Assy. Fixture(Φ97)	TC9762625021
03	Tandem type Bi directional Dry Gas Seal (Φ132) with Barrier seal	TC9762625030
04	DGS Assy/Dis Assy. Fixture(Φ132)	TC9762625048

4. SEAL HOUSING & SHAFT DIMENSIONS

Please refer TC52508 **Var No 12** (DGS DIA 97 BCL400 SERIES for END MOUNTED BEARING DESIGN) and **Var No 11** (DGS DIA 132 BCL400/A HIGH PRESSURE SERIES for END MOUNTED BEARING DESIGN) for Seal housing and shaft dimensions.

All the interface assembly parts including outer closing cover with its pin, "O" rings, tolerance strips (as applicable), keys, locating/ anti-rotation pins, circlips etc. are in vendor scope.

The outer closing cover shall be provided with the milled projections as shown in the sketch to facilitate free oil drain.

The dimensions indicated in the sketch shall be strictly adhered to.



PRODUCT STANDARD
TURBINES AND COMPRESSORS
HYDERABAD

TC-6-2625

REV No.: 00

PAGE 3 OF 7

5. SEAL DESIGN INPUTS

5.1. DATA FOR SEAL DESIGN

OPERATING CONDITION		RATE D	C2	STAR T-UP	RATED_ MINMW	RATED_ MAX MW	C2_ MIN MW	C2_ MAX MW
PARAMETER DESCRIPTION								
Gas Composition		As per annexure-1						
Mol. wt.		9.650	9.640	28.010	9.000	11.000	9.000	11.000
Pr. in the Average Seal gas line upstream of filter (kg/cm2-a)		81.09	71.08	17.82	81.05	81.08	71.01	71.02
Temp in Seal gas Line upstream of filter (°C)		116.69	106.36	133.95	116.87	116.44	106.52	105.80
Clean gas pressure (downstream of DPCV1) (kg/cm2-a)		23.10	23.10	5.50	23.10	23.10	23.10	23.10
Clean gas temperature (downstream of DPCV1) (°C)		116.69	106.36	133.95	116.87	116.44	106.52	105.80
Clean gas pressure (downstream of DPCV2) (kg/cm2-a)		44.68	42.24	10.54	44.66	44.62	42.23	42.28
Clean gas temperature (downstream of DPCV2) (°C)		116.69	106.36	133.95	116.87	116.44	106.52	105.80
Total clean gas leaking into Compr. through end labyrinth seals (both ends) Downstream of DPCV1 (into LP Compressor)	NOR (Kg/hr)	124	125	100	119	132	121	134
	NOR (Am3/hr)	18	18	22	19	17	19	17
	Max (Kg/hr)	185	188	150	179	198	182	201
	Max (Am3/hr)	27	27	34	28	26	28	25
Shaft Speed(rpm)		11118	10299	8231	11395	10617	10565	9814
Total clean gas leaking into Compr. through end labyrinth seals (both ends) Downstream of DPCV2 (into HP Compressor)	NOR (Kg/hr)	317	313	257	306	338	302	334
	NOR (Am3/hr)	24	25	30	25	23	26	23
	Max (Kg/hr)	475	469	386	459	507	453	502
	Max (Am3/hr)	37	37	45	38	35	39	35
Shaft Speed(rpm)		11118	10299	8231	11395	10617	10565	9814
System settling out press.(kg/cm²-g)		81						
Rated Speed (rpm)		11395						
Min. mechanical design pressure for DGS		89 kg/cm2 g						
Mechanical design temperature for DGS		Min → 0 °C Max → 180 °C						
Back Pressure in Primary vent		Nor → 0.1kg/cm2-g / Max → 1.7kg/cm2-g						

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COMP. FILE NAME

Ref. Doc.



PRODUCT STANDARD
TURBINES AND COMPRESSORS
HYDERABAD

TC-6-2625REV No.: **00**

PAGE 4 OF 7

- Performance Guarantee case is **c2**
- Rated Speed is 11395 RPM
- Maximum Continuous Speed(MCS) is 11965 RPM
- Minimum Speed is 7966 RPM (70 %)
- Trip Speed is 13162 RPM
- Slow roll requirement: Not applicable/However, there will be tilting operation with 4 strokes per minute wherein each stroke rotation is 60 deg.

5.2. AMBIENT CONDITIONS

Temperature	:	Min → 5.0 °C Max → 38.0 °C
Relative Humidity	:	Nor.95 % @ 37 °C

5.3. GAS COMPOSITION FOR VARIOUS CONTINUOUS OPERATING CONDITIONS:

The gas composition for all the above operating conditions is furnished at **Annexure-1 /**

5.4. SEALING GAS

Primary Seal	For Normal Operation	Dry and filtered process gas from makeup discharge/ Nitrogen / Sweet Gas
	During Starting	Seal Gas (Nitrogen) from Seal Gas Booster Nitrogen from Header for N2 Start UP
	During Settle Down	Nitrogen from Seal Gas Booster
Secondary Seal	Nitrogen / Plugged	
Barrier Seal	Nitrogen / Instrument Air	

Gas	Parameter	Min	Nor	Max	Mech. Design
Nitrogen	Pressure Kg/Cm ² g	4.5	6.5	7	10.5
	Temperature °C		Ambient		65
Sweet Gas	Pressure Kg/Cm ² g	NA			
	Temperature °C				
Instrument Air	Pressure Kg/Cm ² g	NA			
	Temperature °C				
MUG Compressor	Disch. Pressure Kg/Cm ² g	NA			
	Disch. Temperature °C				



PRODUCT STANDARD
TURBINES AND COMPRESSORS
HYDERABAD

TC-6-2625REV No.: **00**

PAGE 5 OF 7

6. SPECIAL POINTS

1. Dry gas seal vendor shall submit written confirmation in their letterhead for the following:
 - a. The spare seal (not installed in casing) shall be suitable for use without any refurbishment for at least 5 years from the date of supply. Vendor shall provide necessary storage conditions to comply with the above.
 - b. If the spare seals are not used at all before 5 years and if the vendor's design standard practice is calling for any refurbishment / revalidation / requalification, after 5 years but before 10 years period vendor shall accept to refurbish the spare seals free of charge for one time to the end customer.
 - c. If the spare seals are used before 5 years, the above Part-b is not applicable.
2. Materials in contact with gas at a temperature above 150 deg C shall be stainless steel. Vendor to consider inlet gas to each stage at dew point. Inter-stage equipment in contact with wet process gas or gas less than 10 deg C above the dew point must be made from stainless steel.
3. Primary seal gas vent shall be routed to Flare. The primary seal leakage rate shall be guaranteed. Maximum process gas loss for both LP and HP Compressors together shall be 50Nm³/hr.

7. Applicable Standards / Codes

- 7.1. BHEL General Specification No. TC52357
- 7.2. BHEL Housing Dimension Specification No. TC52508
- 7.3. API 617 – 7th edition
- 7.4. API 614 – 5th edition

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Rev. 5
Form No.



PRODUCT STANDARD
TURBINES AND COMPRESSORS
HYDERABAD

TC-6-2625
REV No.: **00**
PAGE 6 OF 7

ANNEXURE - 1
GAS COMPOSITION

Gas analysis															
		RATED		C2(Design)		STARTUP		RATED MIN		RATED MAX		C2 MIN		C2 MAX	
Constituent	MW	Makeup	Recycle	Makeup	Recycle	Makeup	Recycle	Makeup	Recycle	Makeup	Recycle	Makeup	Recycle	Makeup	Recycle
Air	28.966														
Oxygen	32.000														
Nitrogen	28.013	0.13	0.44	0.13	0.46	100.00	100.00	0.13	0.44	0.13	0.44	0.13	0.44	0.13	0.44
Water	18.015	0.33	0.04	0.33	0.05	0.00	0.00	0.33	0.04	0.33	0.04	0.33	0.04	0.33	0.04
CO	28.011	17.018	2.16	17.01	1.27	0.00	0.00	17.02	2.16	17.02	2.16	17.02	2.16	17.02	2.16
CO ₂	44.010	6.249	2.75	6.25	2.28	0.00	0.00	4.73	1.1	9.47	5.87	4.73	1.10	9.47	5.87
H ₂ S	34.079														
Hydrogen	2.016	72.743	82.22	72.75	82.8	0.00	0.00	74.26	83.87	69.52	79.1	74.26	83.87	69.52	79.10
Methane	16.043	3.53	11.79	3.53	12.5	0.00	0.00	3.53	11.79	3.53	11.79	3.53	11.79	3.53	11.79
Ethylene	28.054														
Ethane	30.070														
Propylene	42.081														
Propane	44.097														
1 Butene	56.108														
i-Butane	58.124														
n-Butane	58.124														
Cyclopenta	70.135														
Cyclopente	68.120														
13Pentadie	68.120														
1 Pentene	70.135														
i-Pentane	72.151														
n-Pentane	72.151														
Hexane	89.95														
Methanol	32.042	0.00	0.57	0.00	0.62	0.00	0.00	0.00	0.57	0.00	0.57	0.00	0.57	0.00	0.57
Ethanol	46.069	0.00	0.03	0.00	0.02	0.00	0.00	0.00	0.03	0.00	0.03	0.00	0.03	0.00	0.03
Total		100	100	100	100	100	100	100	100	100	100	100	100	100	100
Avg.Mol.		9.65	5.69	9.64	5.38	28.01	28.01	9.0	5.0	11	7	9	5	11	7

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