

TITLE PROCESS DATASHEET - BOOSTER COMPRESSOR PACKAGE (DAUGHTER STATION)						ITEM/TAG No. REFER BASIS-33		DOCUMENT No. 16017-P-DS-0107	
PROJECT DESCRIPTION CONSTRUCTION OF CITY GAS STATION CUM CNG MOTHER STATIONS & DAUGHTER BOOSTER STATIONS						PROJECT No. KIP-16017		SHEET 1 OF 4	REVISION B
EPCM CONSULTANT KAVIN				CLIENT CONTRACT NO -		REQUISITION No. -		SPECIFICATION No. -	
CLIENT NAME	REV No.	BY	DATE	CKD	DATE	APP	DATE	DESCRIPTION	
GODAVARI GAS PRIVATE LIMITED	A	SS	14-Oct-16	NK/TKV	14-Oct-16	MRM/BSK	14-Oct-16	ISSUED FOR REVIEW	
CLIENT'S REF:	B	SS	23-Nov-16	NK/TKV	23-Nov-16	MRM/BSK	23-Nov-16	ISSUED FOR APPROVAL	
-									
ORIGINATOR	ORIG. DATE								
SS	12-Oct-16								

DESIGN BASIS

GENERAL:

Godavari Gas Private Limited (GGPL) is a Joint Venture of Andhra Pradesh Gas Distribution Corporation Limited (APGDC) and Hindustan Petroleum Corporation Limited (HPCL). GGPL has been set up to develop City Gas Distribution Projects including CNG Stations in East and West Godavari Districts. GGPL requires two (2) numbers of variable suction reciprocating Compressor to be installed at the CNG outlets of GGPL and OMC (Oil Manufacturing Company) retail Outlets located in East and West Godavari Districts. The suction of the compressor will be from Light Commercial Vehicle (LCV) mounted mobile cascades provided by GGPL/ On line natural gas supply from pipeline and the compressed natural gas (CNG) will be dispensed in vehicles by the dispensers installed by GGPL.

The compressor package shall be designed in order to be converted to on-line compressor capable of taking suction from gas lines when available within the range of 19 to 26 kg/cm²g without major modifications.

FEED GAS CONDITIONS :

Feed gas process conditions are as follows,

Pressure	19-210	kg/cm ² g	Note-14
Temperature	39	°C	
Flowrate	250	SCMH	

STANDARDS / CODES

1. PNGRB standards
2. Published standards
3. Indian standards
4. Oil India Safety Directorate (OISD)
5. API-11P, Second edition, API 618
6. International standards : ANSI, ASME, ASTM, API, SA, NACE, ISO, DIN, EN, etc

SCOPE OF SUPPLY FOR EACH COMPRESSOR PACKAGE:

1. Each compressor Package shall be complete with:

- a). Common structural steel skid for the compressor- Motor combination and for all auxiliary systems
 - i. Air-cooled heat exchanger for interstage and discharge gas.
 - ii. 4 line (3 bank) Priority Panel at Package Discharge.
 - iii. All interconnecting oil, gas, water, air piping within the compressor package.
 - iv. Impulse and pneumatic piping/Tubing for all valves, fittings as specified & required for mounting the instruments. Block and bleed valves to be provided for Pressure gauges and pressure Transmitters.
 - v. Separate junction boxes for different type of signals like intrinsically safe signals, alarm, shutdowns, thermocouples, RTDs etc. for interfacing to local panel.
 - vi. NRV at final discharge.
 - vii. Structural supports within the compressor package for all piping, instruments etc.
 - viii. Y- type strainers, valves, sight flow indicators, check valves, auto & manual drain traps etc. as required for various auxiliary systems i.e. frame lube oil, cylinder lubrication system, cooling water systems etc.
 - ix. Acoustic enclosure for Compressor package , with one number L.E.L detectors and one UV detectors in the enclosure.
 - x. Common CO₂ extinguishing system consisting of two cylinders, piping, valves and control systems
 - xi. Inlet and outlet manual and automatic isolating valves for maintenance & emergency.

2. UTILITIES

- a). Vendor shall make his own provision for Instrument air if required with an electric motor driven air compressor with a suitably sized receiver system. Air Compressor motor should be 415 V squirrel cage motor starter having overload protection, single phase preventer.
- b). Cooling water is not available as utility and the package shall be provided with self sufficient cooling water system for Compressor, as required, with make up tank.

TITLE PROCESS DATASHEET - BOOSTER COMPRESSOR PACKAGE (DAUGHTER STATION)							ITEM/TAG No. REFER BASIS-33	DOCUMENT No. 16017-P-DS-0107	
PROJECT DESCRIPTION CONSTRUCTION OF CITY GAS STATION CUM CNG MOTHER STATIONS & DAUGHTER BOOSTER STATIONS							PROJECT No. KIP-16017	SHEET 2 OF 4	REVISION B
EPCM CONSULTANT KAVIN				CLIENT CONTRACT NO -			REQUISITION No. -	SPECIFICATION No. -	
CLIENT NAME	REV No.	BY	DATE	CKD	DATE	APP	DATE	DESCRIPTION	
GODAVARI GAS PRIVATE LIMITED	A	SS	14-Oct-16	NK/TKV	14-Oct-16	MRM/BSK	14-Oct-16	ISSUED FOR REVIEW	
CLIENT'S REF:	B	SS	23-Nov-16	NK/TKV	23-Nov-16	MRM/BSK	23-Nov-16	ISSUED FOR APPROVAL	
-									
ORIGINATOR	ORIG. DATE								
SS	12-Oct-16								

DESIGN BASIS


c). CO₂ FLOODING SYSTEM:

The package shall be protected by automatically operated CO₂ flooding system designed as per NFPA-12, which should have minimum following features: -

- i). Gas Detection by installation of hydrocarbon gas detector (IR type) and transmitter with adjustable alarm levels (0-100%) with preset of 10%, 20% and 50%. Package should have at least 2 nos. gas detectors.
 - ii). Installation of flame detector (UV-IR type) and transmitter, alarm on detection of flame. Package should have at least 2 nos. flame detectors.
 - iii). CO₂ flooding system shall consist of 2 nos. of min 45 kg CO₂ cylinders. However actual size of the cylinder shall be as per compressor enclosure size. One cylinder will act as main cylinder & other as stand by, which shall have identical arrangement and connected to the system. The cylinders shall be protected from weather and direct sunrays as per Gas Cylinder Rules, 2004. Cylinders shall be fitted with actuated Valves, Solenoid valves etc. for automatic actuation. Control philosophy shall be such that in case main cylinder fails the standby cylinder shall discharge automatically. For this the vendor shall provide suitable device such as pressure switch (intrinsically safe type) to detect the failure of main Cylinders failure. One manual switch / call point shall be provided to operate the CO₂ cylinder from remote control room. Pull down lever on cylinder valve for manual operation shall be provided.
3. All customer interface connections (i.e. Gas Inlet & Gas Outlet) shall be brought out to the package edge. Gas inlet shall be terminated in nozzles with isolation valves having flange connections and Gas outlet (priority panel outlet connection) shall be terminated through high pressure ¾" full flow ball valves with ¾" end connectors.
 4. All vents (i.e. Relief valve, distance piece and packing) shall be manifolded and terminated at skid edge outside the enclosure and vented to safe height of 2.5m at package roof with proper support.
 5. All drains from different process equipment, distance piece and packing shall be manifolded and terminated as single point for customer interface duly flanged with isolation valve.
 6. Offered package shall be complete with compressor, electric motor, piping, cooling system, suction and discharge filters, priority fill system, control panel safety and control devices and other accessories required for automatic and safe operation of the system. The supply shall include all interconnecting piping/tubing/cables. Cooling system shall be of closed circuit type. Ultimate cooling shall be by air only.
 7. The compressor package control system shall be designed for unattended safe operation in automatic mode and shall unload, start, load, stop safely. The compressor shall start in auto in case high bank storage pressure falls below 210 kg/cm²g and stop once the pressure in all three banks of storage cascade reaches 255 kg/cm²g.
 8. The Variable Suction Compressor shall be suitable for continuous operation on variable suction pressure from 210 kg/cm²g to 19 kg/cm²g, supplied through LCV mounted CNG storage cascade/ On line Supply of natural gas through pipeline and discharge pressure of 255 kg/cm²g.
 9. The compressor shall be designed in order to be converted to on-line compressor capable of taking suction from gas lines when available within the range of 19 to 26 kg/cm²g without major modifications.
 10. Noise level shall not exceed 75 dBA at 1m from the compressor package enclosure.
 11. The compressor shall be designed to work for full suction pressure range of 210 kg/cm²g to 19 kg/cm²g. However designing for the throttling of gas at inlet of compressor to be done by the vendor.
 12. Compressor Vendor to provide the minimum instruments requirement for Booster compressor package.
 13. Compressor package shall be provided with following instruments:
 - a). All tripping shall be with lamp indication and annunciation.
 - b). Temperature indicaton: 1st, 2nd stage discharge and after- after cooler.
 - c). Pressure indication: 2nd stage discharge, high & medium bank; Pressure switch 2nd stage discharge, high & medium bank.
 - d). Coolant: Temp & pr indication & switch and temp indication after cooler.
 - e). Hour meter.
 - f). One no. Pressure Switch/Transmitter shall be installed in the inlet line to compressor.
 - g). One no. Coriolis mass flow meter with integral local display with transmitter shall be installed for metering of gas.
 14. Package supplier is responsible to provide full process design to meet performance as specified in the datasheet.
 15. Process design deliverables to include:
 - a) Process design calculations
 - b) P&Ids
 - c) Package battery limit connections list and utilities consumption.
 - d) Cause & Effect, Control settings list and Trip and alarm settings definition list.
 16. All controls shall be handled by the compressor UCP which shall be located in safe area.
 17. Compressor suction scrubbers shall be fitted with vane pack mist eliminator. Vane pack shall remove liquid droplets down to 10 microns or below.
 18. Supplier to select suitable inlet device for the compressor suction scrubbers.

TITLE PROCESS DATASHEET - BOOSTER COMPRESSOR PACKAGE (DAUGHTER STATION)							ITEM/TAG No. REFER BASIS-33		DOCUMENT No. 16017-P-DS-0107	
PROJECT DESCRIPTION CONSTRUCTION OF CITY GAS STATION CUM CNG MOTHER STATIONS & DAUGHTER BOOSTER STATIONS							PROJECT No. KIP-16017		SHEET 3 OF 4	
EPCM CONSULTANT KAVIN							CLIENT CONTRACT NO -		REQUISITION No. -	
SPECIFICATION No. -										
CLIENT NAME		REV No.	BY	DATE	CKD	DATE	APP	DATE	DESCRIPTION	
GODAVARI GAS PRIVATE LIMITED		A	SS	14-Oct-16	NK/TKV	14-Oct-16	MRM/BSK	14-Oct-16	ISSUED FOR REVIEW	
CLIENT'S REF:		B	SS	23-Nov-16	NK/TKV	23-Nov-16	MRM/BSK	23-Nov-16	ISSUED FOR APPROVAL	
-										
ORIGINATOR	ORIG. DATE									
SS	12-Oct-16									

1	<p style="text-align: center;">DESIGN BASIS</p> <p>19. Supplier shall provide complete filled in datasheet in API 618 format for compressors.</p> <p>20. Total liquid carry over in the gas outlet stream from suction scrubbers shall not exceed 0.1 US Gal / MMSCF (13.4 Litres / MMSCM).</p> <p>21. Design code applicable shall be ASME and API 618. Supplier to provide deviations if any.</p> <p>22. Supplier shall ensure that the maximum predicted discharge temperature shall be within the API requirement.</p> <p>23. A high discharge temperature alarm transmitter shall be provided for each compressor cylinder.</p> <p>24. The MAWP of the cylinder shall exceed the maximum discharge pressure that the compressor can generate by at 10%.</p> <p>25. The motor rating shall not be 110% of the maximum power required (including power transmission losses) for any specified operating conditions. In addition the major rating shall not be less than 105% of the power required (including power transmission losses) for the relief conditions.</p> <p>26. The compressor system shall be designed to prevent air ingress in the system during startup, operation and shutdown. Necessary instrumentation shall be provided.</p> <p>27. All material used in the package shall be flame retardant.</p> <p>28. Relief valves shall be provided at suction and discharge and each inter stages of compressor with setting as per cl.7.20.4 of API-11P with R.V. venting as per cl. 7.20.4 of API-11P. All vented to common relief valve header.</p> <p>29. Emergency shut down (ESD) System is also in scope of vendor. A fail-safe system shall be designed and incorporated to isolate cascades storage from dispensers, stop compressor isolate the compressor suction and cut off power supply on activation of ESD switch. This ESD switch shall have to be manually reset to restart the compressor package again. To isolate dispensers actuators of dispensers may be used.</p> <p>30. All gas piping/ tubing, valves, fittings etc. from Suction of the 1st stage (right from interface) through final discharge from the compressor (upto interface) shall be SS-316 material with double compression ferrule fittings.</p> <p>31. The Compressor Package shall trip if any of the enclosure is opened while the machine is running.</p> <p>32. Design code for</p> <ul style="list-style-type: none"> i) Piping - ASME/ANSI B 31.3 ii) Pressure Vessel - ASME SEC-VIII, DIV 1 iii) Gas Cooler - Preferable API-661 <p>33. Two (2) Booster Compressor Package tag number shall be 6020 and 7020 accordingly.</p> <p>34. Tag sequence number shall be 6000-8000 for Three (3) Two (2) Booster Compressor Package.</p>
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	
21	
22	
23	
24	
25	
26	
27	
28	
29	
30	
31	
32	
33	
34	
35	
36	
37	
38	
39	
40	
41	
42	
43	
44	
45	
46	
47	
48	
49	
50	
51	
52	
53	
54	
55	
56	
57	
58	
59	
60	



TITLE PROCESS DATASHEET - BOOSTER COMPRESSOR PACKAGE (DAUGHTER STATION)							ITEM/TAG No. REFER BASIS-33		DOCUMENT No. 16017-P-DS-0107		
PROJECT DESCRIPTION CONSTRUCTION OF CITY GAS STATION CUM CNG MOTHER STATIONS & DAUGHTER BOOSTER STATIONS							PROJECT No. KIP-16017		SHEET 4 OF 4		REVISION B
EPCM CONSULTANT KAVIN				CLIENT CONTRACT NO -			REQUISITION No. -		SPECIFICATION No. -		
CLIENT NAME GODAVARI GAS PRIVATE LIMITED		REV No. A	BY SS	DATE 14-Oct-16	CKD NK/TKV	DATE 14-Oct-16	APP MRM/BSK	DATE 14-Oct-16	DESCRIPTION ISSUED FOR REVIEW		
CLIENT'S REF: -		B	SS	23-Nov-16	NK/TKV	23-Nov-16	MRM/BSK	23-Nov-16	ISSUED FOR APPROVAL		
ORIGINATOR SS											
ORIG. DATE 12-Oct-16											
1 Service : GAS							Equipment Tag No. : -				
2 Configuration : 1 x100%							Running : 1 Spare :				
3 Compressor Type : Non-Lubricating type, Variable suc. Pressure Reciprocating							Driver Type : Electrical Motor Driven				
4 Design Margin : -							Capacity Control : Automatic (VTA)				
5 Process Data : For One Compressor							No of Stages : VTA				
6 Design Cases : -							No Required : 2				
7 Gas Handled : Compressed Natural Gas (CNG)							Design Code : API 618, API-11P Second Edition				
8 Class/Zone : Class 1, Zone 1, Division 1, Gas Group D, Group IIA, IIB											
9 CASE-1											
10 Parameters			Units		Booster Compressor Package			Remarks			
11 Volume Flow			SCMH		250.00						
12 Mass Flow			kg/hr		182.03			Note-13			
13 Inlet Conditions											
14 Suction Pressure			kg/cm ² g		19-210			Note-14			
15 Suction Temperature			°C		39.00			Note-13			
16 Molecular Weight			kg/kmol		17.25			Note-13			
17 Mass Density			kg/m ³		33.04			Note-13			
18 Specific heat ratio					1.429			Note-13			
19 Compressibility factor					0.9121			Note-13			
20 Discharge Condions											
21 Discharge Pressure			kg/cm ² g		255.00			Note-4,5			
22 Discharge Temperature			°C		55.00			Note-1,6			
23 Mass Density			kg/m ³		181.7 (VTC)			Note-13			
24 Compressibility factor					0.8719 (VTC)			Note-13			
25 Polytropic Efficiency			%		Note-7						
26 Duty			kW		22			Note-8,9			
27 Total Power			kW		VTA						
28 Compositions in Mole %											
29											
30			Components		Design Case - Gas Composition Range		Normal Case				
31 Methane					82.0 – 99.0		95.21				
32 Ethane					7.5 – 0.9		1.82				
33 Propane					3.5 – 0.0		0.57				
34 i-Butane					0.75 – 0.0		0.20				
35 n-Butane					0.75 – 0.0		0.13				
36 i-Pentane					0.15 – 0.0		0.06				
37 n-Pentane					0.15 – 0.0		0.05				
38 Hexane					0.25 – 0.0		0.21				
39 Carbondioxide					4.9 – 0.0		1.46				
40 Nitrogen					0.08 – 0.0		0.29				
41 H2S					10 ppm		10 ppm				
42											
43											
44 NOTES :											
45											
46											
47											
48											
49											
50											
51											
52											
53											
54											
55											
56											
57											
58											
59											
60											
61											
62											
63											
64											
65											
66											
67											