BHAGYANAGAR GAS LIMITED

(A JOINT VENTURE OF HPCL & GAIL)

BID DOCUMENTS FOR

SUPPLY OF CNG RECIPROCATING COMPRESSORS ON ARC BASIS FOR A PERIOD OF 18 MONTHS IN GAs OF BHAGYANAGAR GAS LIMITED

UNDER OPEN DOMESTIC COMPETITIVE BIDDING

Bid Document No.: 043-LEPL-BGL-09

VOLUME- II of II
TECHNICAL

PMC:

M/s. Lyons Engineering Pvt. Ltd.

MATERIAL REQUISITION
FOR
SUPPLY OF CNG RECIPROCATING COMPRESSORS ON ARC BASIS FOR A PERIOD OF 18 MONTHS IN GAs (HYDERABAD, VIJAYAWADA & KAKINADA) OF BHAGYANAGAR GAS LIMITED

PREPARED AND ISSUED BY

LYONS ENGINEERING PVT. LTD.

NEW DELHI INDIA

MATERIAL REQUISITION

PROJECT: CITY GAS DISTRIBUTION PROJECT AT HYDERABAD, VIJAYAWADA & KAKINADA GA
CLIENT: BHAGYANAGAR GAS LIMITED (BGL)
ITEMS: SUPPLY OF CNG RECIPROCATING COMPRESSORS ON ARC BASIS FOR A PERIOD OF 18 MONTHS

SL. NO.	DESCRIPTION OF ITEMS	QTY	UOM	REMARKS
GROUP-A.1	1200 SCMH GAS ENGINE DRIVEN CNG COMPRESSORS AND ITS ASSOCIATED AUXILIARIES (SUPPLY)			
PART-1	HYDERABAD			
1	Design, Engineering, Manufacturing, String test, Supply including packaging and forwarding, insurance, custom clearance, handling, loading and unloading of Skid mounted Gas Engine Driven Reciprocating compressor package with discharge flow capacity of 1200 SCMH at the specified conditions (as per technical specification and scope of work) with explosion proof electric & control panel complete with power, control cable & 05 nos. of ESDs having suction pressure of 16 kg/cm2(g), inlet line pressure range of 16 – 49 kg/cm2(g) (performance range 16 to 19 kg/cm2(g) with discharge pressure 255 kg/cm2(g) with 9 bank Priority panel along with all special tools and tackles required for erection and commissioning along with CO2 flooding system etc. The compressor shall have provision for overhead mounting of cascade (3000 water liter capacity with approximate weight of 6.5 tons) including the space for operation & maintenance of the cascades. The package shall be inclusive of: a) String test of complete compressor package along with gas engine and accessories at packager's factory including TPIA (Third Party Inspection Agency) Charges. b) Design, Engineering, Manufacturing, Supply including packaging and forwarding, insurance, custom clearance, handling, loading and unloading of air compressor with flame proof motor of 7.5KW capacity (approx.) discharge pressure approx. 16 kg/cm2g, 1000 Water litre capacity air receiver for instrumentation air, air dryer along with all accessories and auxiliaries. Location(s) for delivery will be finalized at the time of Release Order (s).	2	Nos.	
2	Freight up to store/site at Hyderabad GA.	2	Nos.	

3	Re-transportation of packages if delivered at store to respective site including loading & unloading within the same GA.	1	No.	
4	LCV Trailer Panels LCV trailer panel complete with mass flow meter (with internal local display) based on Coriolis principle of Micro motion, USA (Model CNG 50 with 2700 transmitter, cabling, suitable for hazardous area classification. Panel shall be weather proof. Sheet metal work shall be SS 304. LCV trailer panel shall be mounted / installed near LCV stand. Purchaser shall arrange SS316 tubing from compressor to trailer panel and from trailer panel to LCV filling point. Hose & fittings for LCV filling point shall be in bidder's scope. Hose shall be 5 feet in length along with breakaway coupling & fitting (quick connector coupler & Stem) should have provision of NRV. Dispatch of LCV panels shall be as intimated during dispatch clearance.	2	Nos.	
5	INSTALLATION, COMMISSIONING, TESTING			
6	Installation, commissioning & Field performance test of Compressor Package including all accessories/ equipment(s) i.e. air compressor, CO2 flooding system etc. system at site.	2	Nos.	
7	SERVICES FOR OPERATIONS & COMPREHENSIVE MAINTENANCE			Minimum fixed charges of operations for 1 no. shift in terms of percentage of unit Ex-works price of Item No. 1.0 quoted by the Bidder
8	ITEMS FOR OPERATIONS			
9	"Operation charges for 1st year i.e. during Warranty period per shift of 8hrs (2 packages X 3 shifts X 365 days)	2190	No of Shifts	0.0075
10	The quoted rate (for 1 No of shift) for this item must be equal to or more than 0.0075% of unit price (sl.no 1) quoted by the bidder."	2190	No of Shifts	0.0079
11	"Operation charges for 2nd year i.e. after Warranty period per shift of 8hrs (2 packages X 3 shifts X 365 days)	2190	No of Shifts	0.0082

12	"Operation charges for 4th year i.e. after Warranty period per shift of 8hrs (2 packages X 3 shifts X 365 days)	2190	No of Shifts	0.0086
13	The quoted rate (for 1 No of shift) for this item must be equal to or more than 0.0086% of unit price (sl.no 1) quoted by the bidder."	2190	No of Shifts	0.0090
14	**ITEMS FOR COMPREHENSIVE MAINTENANCE**			Minimum fixed charges of Repair & Comprehensive Maintenance for 1 Machine Month in terms of percentage of unit Ex-works price of Item no. 1.0 quoted by the bidder
15	Lump sum Repair & Comprehensive Maintenance charges (excluding the scope covers under warrantee) per Compressor Package including air compressor for 1st year during warrantee period in all Geographical Areas of BGL inclusive of all manpower, spare parts, lubricants and consumables etc. (2 packages X 12 Months) The quoted rate (for 1 Machine Month) for this item must be equal to or more than 0.40% (maximum 1.5%) of unit price (sl.no 1) quoted by the bidder.	24	Machine Months	0.40
16	Lump sum Repair & comprehensive maintenance charges (including major overhaul) per Compressor Package including air compressor in all Geographical Area's under BGL periphery inclusive of all manpower, spare parts, lubricants and consumables etc. For the below mentioned years (2 packages X 12 Months)			
17	For 2nd Year The quoted rate (for 1 Machine Month) for this item must be equal to or more than 0.50% (maximum 1.5%) of unit price (sl.no 1) quoted by the bidder.	24	Machine Months	0.50
18	For 3rd year The quoted rate (for 1 Machine Month) for this item must be equal to or more than 0.55% (maximum 1.5%) of unit price (sl.no 1) quoted by the bidder.	24	Machine Months	0.55
19	For 4th Year The quoted rate (for 1 Machine Month) for this item must be equal to or more than 0.61% (maximum 1.5%) of unit price (sl.no 1) quoted by the bidder.	24	Machine Months	0.61

20	For 5th Year The quoted rate (for 1 Machine Month) for this item must be equal to or more than 0.67% (maximum 1.5%) of unit price (sl.no 1) quoted by the bidder.	24	Machine Months	0.67
GROUP-A.2	**600 SCMH GAS ENGINE DRIVEN CNG COMPRESSORS AND ITS ASSOCIATED AUXILIARIES (SUPPLY)**			
PART-2	**HYDERABAD**			
1	Design, Engineering, Manufacturing, String test, Supply including packaging and forwarding, insurance, custom clearance, handling, loading and unloading of Skid mounted Gas Engine Driven Reciprocating compressor package with discharge flow capacity of 600 SCMH at the specified conditions (as per technical specification and scope of work) with explosion proof electric & control panel complete with power, control cable & 05 nos. of ESDs having suction pressure of 16 kg/cm2(g), inlet line pressure range of 16– 49 kg/cm2(g) (performance range 16 to 19 kg/cm2(g) with discharge pressure 255 kg/cm2(g) with 7 bank Priority panel along with all special tools and tackles required for erection and commissioning along with CO2 flooding system etc. The compressor shall have provision for overhead mounting of cascade (3000 water liter capacity with approximate weight of 6.5 tons) including the space for operation & maintenance of the cascades. The package shall be inclusive of: a) String test of complete compressor package along with gas engine and accessories at packager's factory including TPIA (Third Party Inspection Agency) Charges. b) Design, Engineering, Manufacturing, Supply including packaging and forwarding, insurance, custom clearance, handling, loading and unloading of Air Compressor with flame proof motor of 7.5KW capacity (approx.) discharge pressure approx. 16 kg/cm2g, 1000 Water litre capacity air receiver for instrumentation air, air dryer along with all accessories and auxiliaries. Location(s) for delivery will be finalized at the time of Release Order (s).	1	No.	
2	Freight up to store/site at Hyderabad GA.	1	No.	
3	Re-transportation of packages if delivered at store to respective site including loading & unloading within the same GA.	1	No.	

4	**INSTALLATION, COMMISSIONING, TESTING**			
5	Installation, commissioning & Field performance test of Compressor Package including all accessories/ equipment(s) i.e. air compressor, CO2 flooding system etc. system at site.	1	No.	
6	**SERVICES FOR OPERATIONS & COMPREHENSIVE MAINTENANCE**			Minimum fixed charges of operations for 1 no. shift in terms of percentage of unit Ex-works price of Item No. 1.0 quoted by the bidder
7	**ITEMS FOR OPERATIONS**			
8	Operation charges for 1st year i.e. during Warranty period per shift of 8hrs (1 package X 3 shifts X 365 days) The quoted rate (for 1 No of shift) for this item must be equal to or more than 0.0081% of unit price (sl.no 1) quoted by the bidder.	1095	No of Shifts	0.0081
9	Operation charges for 2nd year i.e. after Warranty period per shift of 8hrs (1 package X 3 shifts X 365 days) The quoted rate (for 1 No of shift) for this item must be equal to or more than 0.0085% of unit price (sl.no 1) quoted by the bidder.	1095	No of Shifts	0.0085
10	Operation charges for 3rd year i.e. after Warranty period per shift of 8hrs (1 package X 3 shifts X 365 days) The quoted rate (for 1 No of shift) for this item must be equal to or more than 0.0089% of unit price (sl.no 1) quoted by the bidder.	1095	No of Shifts	0.0089
11	Operation charges for 4th year i.e. after Warranty period per shift of 8hrs (1 package X 3 shifts X 365 days) The quoted rate (for 1 No of shift) for this item must be equal to or more than 0.0093% of unit price (sl.no 1) quoted by the bidder.	1095	No of Shifts	0.0093
12	Operation charges for 5th year i.e. during Warranty period per shift of 8hrs (1 package X 3 shifts X 365 days) The quoted rate (for 1 No of shift) for this item must be equal to or more than 0.0097% of unit price (sl.no 1) quoted by the bidder.	1095	No of Shifts	0.0097
13	ITEMS FOR COMPREHENSIVE MAINTENANCE			Minimum fixed charges of Repair & Comprehensive Maintenance for 1 Machine Month in terms of percentage of unit Ex-works price of

				Item no. 1.0 quoted by the bidder
14	Lump sum Repair & Comprehensive Maintenance charges (excluding the scope covers under warrantee) per Compressor Package including air compressor for 1st year during warrantee period in all Geographical Areas of BGL inclusive of all manpower, spare parts, lubricants and consumables etc. (1 package X 12 Months) The quoted rate (for 1 Machine Month) for this item must be equal to or more than 0.40% (maximum 1.5%) of unit price (sl.no 1) quoted by the bidder.	12	Machine Months	0.40
15	Lump sum Repair & comprehensive maintenance charges (including major overhaul) per Compressor Package including air compressor in all Geographical Area's under BGL periphery inclusive of all manpower, spare parts, lubricants and consumables etc. For the below mentioned years (1 package X 12 Months)			
16	For 2nd Year The quoted rate (for 1 Machine Month) for this item must be equal to or more than 0.50% (maximum 1.5%) of unit price (sl.no 1) quoted by the bidder.	12	Machine Months	0.50
17	For 3rd year The quoted rate (for 1 Machine Month) for this item must be equal to or more than 0.55% (maximum 1.5%) of unit price (sl.no 1) quoted by the bidder.	12	Machine Months	0.55
18	For 4th Year The quoted rate (for 1 Machine Month) for this item must be equal to or more than 0.61% (maximum 1.5%) of unit price (sl.no 1) quoted by the bidder.	12	Machine Months	0.61
19	For 5th Year The quoted rate (for 1 Machine Month) for this item must be equal to or more than 0.67% (maximum 1.5%) of unit price (sl.no 1) quoted by the bidder.	12	Machine Months	0.67

GROUP-B.1	**1200 SCMH ELECTRIC MOTOR DRIVEN ONLINE CNG COMPRESSORS AND ITS ASSOCIATED AUXILIARIES (SUPPLY)**			
PART-1	**HYDERABAD**			
	Design, Engineering, Manufacturing, String test, Supply including packaging and forwarding, insurance, custom clearance, handling, loading and unloading of Skid mounted Electric Motor Driven Reciprocating compressor package with discharge flow capacity of 1200 SCMH at the specified conditions (as per technical specification and scope of work) with explosion proof electric & control panel complete with power, control cable & 05 nos. of ESDs having suction pressure of 16 kg/cm2(g), inlet line pressure range of16 – 49 kg/cm2(g) (performance range 16 to 19 kg/cm2(g) with discharge pressure 255 kg/cm2(g) with 9 bank Priority panel and 160 KW electric motor along with all special tools and tackles required for erection and commissioning along with CO2 flooding system etc. The compressor shall have provision for overhead mounting of cascade (3000 water liter capacity with approximate weight of 6.5 tons) including the space for operation & maintenance of the cascades. The package shall be inclusive of: a) String test of complete compressor package along with gas engine and accessories at packager's factory including TPIA (Third Party Inspection Agency) Charges. b) Design, Engineering, Manufacturing, Supply including packaging and forwarding, insurance, custom clearance, handling, loading and unloading of air compressor with flame proof motor of 7.5KW capacity (approx.) discharge pressure approx. 16 kg/cm2g, 1000 Water litre capacity air receiver for instrumentation air, air dryer along with all accessories and auxiliaries. Location(s) for delivery will be finalized at the time of Release Order (s).	5	Nos.	
2	Freight up to store/site at Hyderabad GA.	5	Nos.	
3	Re-transportation of packages if delivered at store to respective site including loading & unloading within the same GA.	2	No.	

4	LCV Trailer Panels LCV trailer panel complete with mass flow meter (with internal local display) based on Coriolis principle of Micro motion, USA (Model CNG 50 with 2700 transmitter, cabling, suitable for hazardous area classification. Panel shall be weather proof. Sheet metal work shall be SS 304. LCV trailer panel shall be mounted / installed near LCV stand. Purchaser shall arrange SS316 tubing from compressor to trailer panel and from trailer panel to LCV filling point. Hose & fittings for LCV filling point shall be in bidder's scope. Hose shall be 5 feet in length along with breakaway coupling & fitting (quick connector coupler & Stem) should have provision of NRV. Dispatch of LCV panels shall be as intimated during dispatch clearance.	5	Nos.	
5	**INSTALLATION, COMMISSIONING, TESTING**			
6	Installation, commissioning & Field performance test of Compressor Package including all accessories/ equipment(s) i.e. air compressor, CO2 flooding system etc. system at site.	5	Nos.	
7	**SERVICES FOR OPERATIONS & COMPREHENSIVE MAINTENANCE**			Minimum fixed charges of operations for 1 no. shift in terms of percentage of unit Ex-works price of Item No. 1.0 quoted by the bidder
8	**ITEMS FOR OPERATIONS**			
9	Operation charges for 1st year i.e. during Warranty period per shift of 8hrs (5 packages X 3 shifts X 365 days) The quoted rate (for 1 No of shift) for this item must be equal to or more than 0.0096% of unit price (sl.no 1) quoted by the bidder.	5475	No of Shifts	0.0096
10	Operation charges for 2nd year i.e. after Warranty period per shift of 8hrs (5 packages X 3 shifts X 365 days)The quoted rate (for 1 No of shift) for this item must be equal to or more than 0.0101% of unit price (sl.no 1) quoted by the bidder.	5475	No of Shifts	0.0101
11	Operation charges for 3rd year i.e. after Warranty period per shift of 8hrs (5 packages X 3 shifts X 365 days) The quoted rate (for 1 No of shift) for this item must be equal to or more than 0.0105% of unit price (sl.no 1) quoted by the bidder.	5475	No of Shifts	0.0105
12	Operation charges for 4th year i.e. after Warranty period per shift of 8hrs (5 packages X 3 shifts X 365 days) The quoted rate (for 1 No of shift) for this item must be equal to or more than 0.0110% of unit price (sl.no 1) quoted by the bidder.	5475	No of Shifts	0.0110

13	Operation charges for 5th year i.e. after Warranty period per shift of 8hrs (5 packages X 3 shifts X 365 days) The quoted rate (for 1 No of shift) for this item must be equal to or more than 0.0115% of unit price (sl.no 1) quoted by the bidder.	5475	No of Shifts	0.0115
14	**ITEMS FOR COMPREHENSIVE MAINTENANCE**			Minimum fixed charges of Repair & Comprehensive Maintenance for 1 Machine Month in terms of percentage of unit Ex-works price of Item no. 1.0 quoted by the bidder
15	Lump sum Repair & Comprehensive Maintenance charges (excluding the scope covers under warrantee) per Compressor Package including air compressor for 1st year during warrantee period in all Geographical Areas of BGL inclusive of all manpower, spare parts, lubricants and consumables etc. (5 packages X 12 Months) The quoted rate (for 1 Machine Month) for this item must be equal to or more than 0.40% (maximum 1.5%) of unit price (sl.no 1) quoted by the bidder.	60	Machine Months	0.40
16	Lump sum Repair & comprehensive maintenance charges (including major overhaul) per Compressor Package including air compressor in all Geographical Area's under BGL periphery inclusive of all manpower, spare parts, lubricants and consumables etc. For the below mentioned years (5 packages X 12 Months)			
17	For 2nd Year The quoted rate (for 1 Machine Month) for this item must be equal to or more than 0.50% (maximum 1.5%) of unit price (sl.no 1) quoted by the bidder.	60	Machine Months	0.50
18	For 3rd year The quoted rate (for 1 Machine Month) for this item must be equal to or more than 0.55% (maximum 1.5%) of unit price (sl.no 1) quoted by the bidder.	60	Machine Months	0.55
19	For 4th Year The quoted rate (for 1 Machine Month) for this item must be equal to or more than 0.61% (maximum 1.5%) of unit price (sl.no 1) quoted by the bidder.	60	Machine Months	0.61
20	For 5th Year The quoted rate (for 1 Machine Month) for this item must be equal to or more than 0.67% (maximum 1.5%) of unit price (sl.no 1) quoted by the bidder.	60	Machine Months	0.67
GROUP-B.1	**1200 SCMH ELECTRIC MOTOR DRIVEN ONLINE CNG COMPRESSORS AND ITS ASSOCIATED AUXILIARIES (SUPPLY)**			
PART-2	**KAKINADA**			

1	Design, Engineering, Manufacturing, String test, Supply including packaging and forwarding, insurance, custom clearance, handling, loading and unloading of Skid mounted Electric Motor Driven Reciprocating compressor package with discharge flow capacity of 1200 SCMH at the specified conditions (as per technical specification and scope of work) with explosion proof electric & control panel complete with power, control cable & 05 nos. of ESDs having suction pressure of 16 kg/cm2(g), inlet line pressure range of 16 – 49 kg/cm2(g) (performance range 16 to 19 kg/cm2(g) with discharge pressure 255 kg/cm2(g) with 9 bank Priority panel and 160 KW electric motor along with all special tools and tackles required for erection and commissioning along with CO2 flooding system etc. The compressor shall have provision for overhead mounting of cascade (3000 water liter capacity with approximate weight of 6.5 tons) including the space for operation & maintenance of the cascades. The package shall be inclusive of: a) String test of complete compressor package along with gas engine and accessories at packager's factory including TPIA (Third Party Inspection Agency) Charges. b) Design, Engineering, Manufacturing, Supply including packaging and forwarding, insurance, custom clearance, handling, loading and unloading of air compressor with flame proof motor of 7.5KW capacity (approx.) discharge pressure approx. 16 kg/cm2g, 1000 Water litre capacity air receiver for instrumentation air, air dryer along with all accessories and auxiliaries. Location(s) for delivery will be finalized at the time of Release Order (s).	1	No.	
2	Freight up to store/site at Kakinada GA.	1	No.	
3	Re-transportation of packages if delivered at store to respective site including loading & unloading within the same GA.	1	No.	

4	LCV Trailer Panels LCV trailer panel complete with mass flow meter (with internal local display) based on Coriolis principle of Micro motion, USA (Model CNG 50 with 2700 transmitter, cabling, suitable for hazardous area classification. Panel shall be weather proof. Sheet metal work shall be SS 304. LCV trailer panel shall be mounted / installed near LCV stand. Purchaser shall arrange SS316 tubing from compressor to trailer panel and from trailer panel to LCV filling point with hose and fittings. Hose & fittings shall be in bidder's scope. Hose shall be 5 feet in length along with breakaway coupling & fitting (quick connector coupler & Stem) should have provision of NRV. Dispatch of LCV panels shall be as intimated during dispatch clearance.	1	No.	
5	**INSTALLATION, COMMISSIONING, TESTING**			
6	Installation, commissioning & Field performance test of Compressor Package including all accessories/ equipment(s) i.e. air compressor, CO2 flooding system etc. system at site.	1	No.	
7	**SERVICES FOR OPERATIONS & COMPREHENSIVE MAINTENANCE**			Minimum fixed charges of operations for 1 no. shift in terms of percentage of unit Ex-works price of Item No. 1.0 quoted by the bidder
8	**ITEMS FOR OPERATIONS**			
9	Operation charges for 1st year i.e. during Warranty period per shift of 8hrs (1 package X 3 shifts X 365 days) The quoted rate (for 1 No of shift) for this item must be equal to or more than 0.0068% of unit price (sl.no 1) quoted by the bidder.	1095	No of Shifts	0.0068
10	Operation charges for 2nd year i.e. after Warranty period per shift of 8hrs (1 package X 3 shifts X 365 days) The quoted rate (for 1 No of shift) for this item must be equal to or more than 0.0071% of unit price (sl.no 1) quoted by the bidder.	1095	No of Shifts	0.0071
11	Operation charges for 3rd year i.e. after Warranty period per shift of 8hrs (1 package X 3 shifts X 365 days) The quoted rate (for 1 No of shift) for this item must be equal to or more than 0.0074% of unit price (sl.no 1) quoted by the bidder.	1095	No of Shifts	0.0074
12	Operation charges for 4th year i.e. after Warranty period per shift of 8hrs (1 package X 3 shifts X 365 days) The quoted rate (for 1 No of shift) for this item must	1095	No of Shifts	0.0077

	be equal to or more than 0.0077% of unit price (sl.no 1) quoted by the bidder.			
13	Operation charges for 5th year i.e. after Warranty period per shift of 8hrs (1 package X 3 shifts X 365 days) The quoted rate (for 1 No of shift) for this item must be equal to or more than 0.0080% of unit price (sl.no 1) quoted by the bidder.	1095	No of Shifts	0.0080
14	**ITEMS FOR COMPREHENSIVE MAINTENANCE**			Minimum fixed charges of Repair & Comprehensive Maintenance for 1 Machine Month in terms of percentage of unit Ex-works price of Item no. 1.0 quoted by the bidder
15	Lump sum Repair & Comprehensive Maintenance charges (excluding the scope covers under warrantee) per Compressor Package including air compressor for 1st year during warrantee period in all Geographical Areas of BGL inclusive of all manpower, spare parts, lubricants and consumables etc. (1 package X 12 Months) The quoted rate (for 1 Machine Month) for this item must be equal to or more than 0.40% (maximum 1.5%) of unit price (sl.no 1) quoted by the bidder.	12	Machine Months	0.40
16	Lump sum Repair & comprehensive maintenance charges (including major overhaul) per Compressor Package including air compressor in all Geographical Area's under BGL periphery inclusive of all manpower, spare parts, lubricants and consumables etc. For the below mentioned years (1 package X 12 Months)			
17	For 2nd Year The quoted rate (for 1 Machine Month) for this item must be equal to or more than 0.50% (maximum 1.5%) of unit price (sl.no 1) quoted by the bidder.	12	Machine Months	0.50
18	For 3rd year The quoted rate (for 1 Machine Month) for this item must be equal to or more than 0.55% (maximum 1.5%) of unit price (sl.no 1) quoted by the bidder.	12	Machine Months	0.55
19	For 4th Year The quoted rate (for 1 Machine Month) for this item must be equal to or more than 0.61% (maximum 1.5%) of unit price (sl.no 1) quoted by the bidder.	12	Machine Months	0.61
20	For 5th Year The quoted rate (for 1 Machine Month) for this item must be equal to or more than 0.67% (maximum 1.5%) of unit price (sl.no 1) quoted by the bidder.	12	Machine Months	0.67

GROUP-B.2	**600 SCMH ELECTRIC MOTOR DRIVEN ONLINE CNG COMPRESSORS AND ITS ASSOCIATED AUXILIARIES (SUPPLY)**			
PART-3	**HYDERABAD**			
1	Design, Engineering, Manufacturing, String test, Supply including packaging and forwarding, insurance, custom clearance, handling, loading and unloading of Skid mounted Electric Motor Driven Reciprocating compressor package with discharge flow capacity of 600 SCMH at the specified conditions (as per technical specification and scope of work) with explosion proof electric & control panel complete with power, control cable & 05 nos. of ESDs having suction pressure of 16 kg/cm2(g), inlet line pressure range of 16 – 49 kg/cm2(g) (performance range 16 to 19 kg/cm2(g) with discharge pressure 255 kg/cm2(g) with 7 bank Priority panel and 90 KW electric motor along with all special tools and tackles required for erection and commissioning along with CO2 flooding system etc. The compressor shall have provision for overhead mounting of cascade (3000 water liter capacity with approximate weight of 6.5 tons) including the space for operation & maintenance of the cascades. The package shall be inclusive of: a) String test of complete compressor package along with gas engine and accessories at packager's factory including TPIA (Third Party Inspection Agency) Charges. b) Design, Engineering, Manufacturing, Supply including packaging and forwarding, insurance, custom clearance, handling, loading and unloading of air compressor with flame proof motor of 7.5KW capacity (approx.) discharge pressure approx. 16 kg/cm2g, 1000 Water litre capacity air receiver for instrumentation air, air dryer along with all accessories and auxiliaries. Location(s) for delivery will be finalized at the time of Release Order (s).	5	Nos.	
2	Freight up to store/site at Hyderabad GA.	5	Nos.	
3	Re-transportation of packages if delivered at store to respective site including loading & unloading within the same GA.	2	No.	
4	**INSTALLATION, COMMISSIONING, TESTING**			
5	Installation, commissioning & Field performance test of Compressor Package including all accessories/ equipment(s) i.e. air compressor, CO2 flooding system etc. system at site.	5	Nos.	

6	**SERVICES FOR OPERATIONS & COMPREHENSIVE MAINTENANCE**			Minimum fixed charges of operations for 1 no. shift in terms of percentage of unit Ex-works price of Item No. 1.0 quoted by the bidder
7	**ITEMS FOR OPERATIONS**			
8	Operation charges for 1st year i.e. during Warranty period per shift of 8hrs (5 packages X 3 shifts X 365 days) The quoted rate (for 1 No of shift) for this item must be equal to or more than 0.0106% of unit price (sl.no 1) quoted by the bidder.	5475	No of Shifts	0.0106
9	Operation charges for 2nd year i.e. after Warranty period per shift of 8hrs (5 packages X 3 shifts X 365 days) The quoted rate (for 1 No of shift) for this item must be equal to or more than 0.0111% of unit price (sl.no 1) quoted by the bidder.	5475	No of Shifts	0.0111
10	Operation charges for 3rd year i.e. after Warranty period per shift of 8hrs (5 packages X 3 shifts X 365 days) The quoted rate (for 1 No of shift) for this item must be equal to or more than 0.0116% of unit price (sl.no 1) quoted by the bidder.	5475	No of Shifts	0.0116
11	Operation charges for 4th year i.e. after Warranty period per shift of 8hrs (5 packages X 3 shifts X 365 days) The quoted rate (for 1 No of shift) for this item must be equal to or more than 0.0121% of unit price (sl.no 1) quoted by the bidder.	5475	No of Shifts	0.0121
12	Operation charges for 5th year i.e. after Warranty period per shift of 8hrs (5 packages X 3 shifts X 365 days) The quoted rate (for 1 No of shift) for this item must be equal to or more than 0.0126% of unit price (sl.no 1) quoted by the bidder.	5475	No of Shifts	0.0126
13	**ITEMS FOR COMPREHENSIVE MAINTENANCE**			Minimum fixed charges of Repair & Comprehensive Maintenance for 1 Machine Month in terms of percentage of unit Ex-works price of Item no. 1.0 quoted by the bidder

14	Lump sum Repair & Comprehensive Maintenance charges (excluding the scope covers under warrantee) per Compressor Package including air compressor for 1st year during warrantee period in all Geographical Areas of BGL inclusive of all manpower, spare parts, lubricants and consumables etc. (5 packages X 12 Months) The quoted rate (for 1 Machine Month) for this item must be equal to or more than 0.40% (maximum 1.5%) of unit price (sl.no 1) quoted by the bidder.	60	Machine Months	0.40
15	Lump sum Repair & comprehensive maintenance charges (including major overhaul) per Compressor Package including air compressor in all Geographical Area's under BGL periphery inclusive of all manpower, spare parts, lubricants and consumables etc. For the below mentioned years (5 packages X 12 Months)			
16	For 2nd Year The quoted rate (for 1 Machine Month) for this item must be equal to or more than 0.50% (maximum 1.5%) of unit price (sl.no 1) quoted by the bidder.	60	Machine Months	0.50
17	For 3rd year The quoted rate (for 1 Machine Month) for this item must be equal to or more than 0.55% (maximum 1.5%) of unit price (sl.no 1) quoted by the bidder.	60	Machine Months	0.55
18	For 4th Year The quoted rate (for 1 Machine Month) for this item must be equal to or more than 0.61% (maximum 1.5%) of unit price (sl.no 1) quoted by the bidder.	60	Machine Months	0.61
19	For 5th Year The quoted rate (for 1 Machine Month) for this item must be equal to or more than 0.67% (maximum 1.5%) of unit price (sl.no 1) quoted by the bidder.	60	Machine Months	0.67
GROUP-B.2	**600 SCMH ELECTRIC MOTOR DRIVEN ONLINE CNG COMPRESSOR PACKAGE**			
PART-4	**VIJAYAWADA**			
1	Design, Engineering, Manufacturing, String test, Supply including packaging and forwarding, insurance, custom clearance, handling, loading and unloading of Skid mounted Electric Motor Driven Reciprocating compressor package with discharge flow capacity of 600 SCMH at the specified conditions (as per technical specification and scope of work) with explosion proof electric & control panel complete with power, control cable & 05 nos. of ESDs having suction pressure of 16 kg/cm2(g), inlet line pressure range of 16 – 49 kg/cm2(g) (performance range 16 to 19 kg/cm2(g) with discharge pressure 255 kg/cm2(g) with 7 bank Priority panel and 90 KW electric motor along with all special tools and tackles required for erection and commissioning along with CO2 flooding system etc. The compressor shall have provision for overhead mounting of cascade (3000 water liter capacity with	1	No.	

	approximate weight of 6.5 tons) including the space for operation & maintenance of the cascades. The package shall be inclusive of: a) String test of complete compressor package along with gas engine and accessories at packager's factory including TPIA (Third Party Inspection Agency) Charges. b) Design, Engineering, Manufacturing, Supply including packaging and forwarding, insurance, custom clearance, handling, loading and unloading of air compressor with flame proof motor of 7.5KW capacity (approx.) discharge pressure approx. 16 kg/cm2g, 1000 Water litre capacity air receiver for instrumentation air, air dryer along with all accessories and auxiliaries. Location(s) for delivery will be finalized at the time of Release Order (s).			
2	Freight up to store/site at Vijayawada GA.	1	No.	
3	Re-transportation of packages if delivered at store to respective site including loading & unloading within the same GA.	1	No.	
5	**INSTALLATION, COMMISSIONING, TESTING**			
5	Installation, commissioning & Field performance test of Compressor Package including all accessories/ equipment(s) i.e. air compressor, CO2 flooding system etc. system at site.	1	No.	
6	**SERVICES FOR OPERATIONS & COMPREHENSIVE MAINTENANCE**			Minimum fixed charges of operations for 1 no. shift in terms of percentage of unit Ex-works price of Item No. 1.0 quoted by the bidder
8	**ITEMS FOR OPERATIONS**			
9	Operation charges for 1st year i.e. during Warranty period per shift of 8hrs (1 package X 3 shifts X 365 days) The quoted rate (for 1 No of shift) for this item must be equal to or more than 0.0090% of unit price (sl.no 1) quoted by the bidder.	1095	No of Shifts	0.0090
10	Operation charges for 2nd year i.e. after Warranty period per shift of 8hrs (1 package X 3 shifts X 365 days) The quoted rate (for 1 No of shift) for this item must be equal to or more than 0.0095% of unit price (sl.no 1) quoted by the bidder.	1095	No of Shifts	0.0095

11	Operation charges for 3rd year i.e. after Warranty period per shift of 8hrs (1 package X 3 shifts X 365 days) The quoted rate (for 1 No of shift) for this item must be equal to or more than 0.0099% of unit price (sl.no 1) quoted by the bidder.	1095	No of Shifts	0.0099
12	Operation charges for 4th year i.e. after Warranty period per shift of 8hrs (1 package X 3 shifts X 365 days) The quoted rate (for 1 No of shift) for this item must be equal to or more than 0.0104% of unit price (sl.no 1) quoted by the bidder.	1095	No of Shifts	0.0104
13	Operation charges for 5th year i.e. after Warranty period per shift of 8hrs (1 package X 3 shifts X 365 days) The quoted rate (for 1 No of shift) for this item must be equal to or more than 0.0109% of unit price (sl.no 1) quoted by the bidder.	1095	No of Shifts	0.0109
14	**ITEMS FOR COMPREHENSIVE MAINTENANCE**			Minimum fixed charges of Repair & Comprehensive Maintenance for 1 Machine Month in terms of percentage of unit Ex-works price of Item no. 1.0 quoted by the bidder
15	Lump sum Repair & Comprehensive Maintenance charges (excluding the scope covers under warrantee) per Compressor Package including air compressor for 1st year during warrantee period in all Geographical Areas of BGL inclusive of all manpower, spare parts, lubricants and consumables etc. (1 package X 12 Months) The quoted rate (for 1 Machine Month) for this item must be equal to or more than 0.40% (maximum 1.5%) of unit price (sl.no 1) quoted by the bidder.	12	Machine Months	0.40
16	Lump sum Repair & comprehensive maintenance charges (including major overhaul) per Compressor Package including air compressor in all Geographical Area's under BGL periphery inclusive of all manpower, spare parts, lubricants and consumables etc. For the below mentioned years (1 package X 12 Months)			
17	For 2nd Year The quoted rate (for 1 Machine Month) for this item must be equal to or more than 0.50% (maximum 1.5%) of unit price (sl.no 1) quoted by the bidder.	12	Machine Months	0.50
18	For 3rd year The quoted rate (for 1 Machine Month) for this item must be equal to or more than 0.55% (maximum 1.5%) of unit price (sl.no 1) quoted by the bidder.	12	Machine Months	0.55

19	For 4th Year The quoted rate (for 1 Machine Month) for this item must be equal to or more than 0.61% (maximum 1.5%) of unit price (sl.no 1) quoted by the bidder.	12	Machine Months	0.61
20	For 5th Year The quoted rate (for 1 Machine Month) for this item must be equal to or more than 0.67% (maximum 1.5%) of unit price (sl.no 1) quoted by the bidder.	12	Machine Months	0.67
GROUP-B.2	**600 SCMH ELECTRIC MOTOR DRIVEN ONLINE CNG COMPRESSOR PACKAGE**			
PART-5	**KAKINADA**			
1	Design, Engineering, Manufacturing, String test, Supply including packaging and forwarding, insurance, custom clearance, handling, loading and unloading of Skid mounted Electric Motor Driven Reciprocating compressor package with discharge flow capacity of 600 SCMH at the specified conditions (as per technical specification and scope of work) with explosion proof electric & control panel complete with power, control cable & 05 nos. of ESDs having suction pressure of 16 kg/cm2(g), inlet line pressure range of 16– 49 kg/cm2(g) (performance range 16 to 19 kg/cm2(g) with discharge pressure 255 kg/cm2(g) with 7 bank Priority panel and 90 KW electric motor along with all special tools and tackles required for erection and commissioning along with CO2 flooding system etc. The compressor shall have provision for overhead mounting of cascade (3000 water liter capacity with approximate weight of 6.5 tons) including the space for operation & maintenance of the cascades. The package shall be inclusive of: a) String test of complete compressor package along with gas engine and accessories at packager's factory including TPIA (Third Party Inspection Agency) Charges. b) Design, Engineering, Manufacturing, Supply including packaging and forwarding, insurance, custom clearance, handling, loading and unloading of air compressor with flame proof motor of 7.5KW capacity (approx.) discharge pressure approx. 16 kg/cm2g, 1000 Water litre capacity air receiver for instrumentation air, air dryer along with all accessories and auxiliaries. Location(s) for delivery will be finalized at the time of Release Order (s).	1	No.	
2	Freight up to store/site at Hyderabad GA.	1	No.	

3	Re-transportation of packages if delivered at store to respective site including loading & unloading within the same GA.	1	No.	
5	**INSTALLATION, COMMISSIONING, TESTING**			
5	Installation, commissioning & Field performance test of Compressor Package including all accessories/ equipment(s) i.e. air compressor, CO2 flooding system etc. system at site.	1	No.	
6	**SERVICES FOR OPERATIONS & COMPREHENSIVE MAINTENANCE**			Minimum fixed charges of operations for 1 no. shift in terms of percentage of unit Ex-works price of Item No. 1.0 quoted by the bidder
8	**ITEMS FOR OPERATIONS**			
9	Operation charges for 1st year i.e. during Warranty period per shift of 8hrs (1 package X 3 shifts X 365 days) The quoted rate (for 1 No of shift) for this item must be equal to or more than 0.0075% of unit price (sl.no 1) quoted by the bidder.	1095	No of Shifts	0.0075
10	Operation charges for 2nd year i.e. after Warranty period per shift of 8hrs (1 package X 3 shifts X 365 days) The quoted rate (for 1 No of shift) for this item must be equal to or more than 0.0079% of unit price (sl.no 1) quoted by the bidder.	1095	No of Shifts	0.0079
11	Operation charges for 3rd year i.e. after Warranty period per shift of 8hrs (1 package X 3 shifts X 365 days) The quoted rate (for 1 No of shift) for this item must be equal to or more than 0.0082% of unit price (sl.no 1) quoted by the bidder.	1095	No of Shifts	0.0082
12	Operation charges for 4th year i.e. after Warranty period per shift of 8hrs (1 package X 3 shifts X 365 days) The quoted rate (for 1 No of shift) for this item must be equal to or more than 0.0086% of unit price (sl.no 1) quoted by the bidder.	1095	No of Shifts	0.0086
13	Operation charges for 5th year i.e. after Warranty period per shift of 8hrs (1 package X 3 shifts X 365 days) The quoted rate (for 1 No of shift) for this item must be equal to or more than 0.0090% of unit price (sl.no 1) quoted by the bidder.	1095	No of Shifts	0.0090
14	**ITEMS FOR COMPREHENSIVE MAINTENANCE**			Minimum fixed charges of Repair & Comprehensive Maintenance for 1 Machine Month in terms of

				percentage of unit Ex-works price of Item no. 1.0 quoted by the bidder
15	Lump sum Repair & Comprehensive Maintenance charges (excluding the scope covers under warrantee) per Compressor Package including air compressor for 1st year during warrantee period in all Geographical Areas of BGL inclusive of all manpower, spare parts, lubricants and consumables etc. (1 package X 12 Months) The quoted rate (for 1 Machine Month) for this item must be equal to or more than 0.40% (maximum 1.5%) of unit price (sl.no 1) quoted by the bidder.	12	Machine Months	0.40
16	Lump sum Repair & comprehensive maintenance charges (including major overhaul) per Compressor Package including air compressor in all Geographical Area's under BGL periphery inclusive of all manpower, spare parts, lubricants and consumables etc. For the below mentioned years (1 package X 12 Months)			
17	For 2nd Year The quoted rate (for 1 Machine Month) for this item must be equal to or more than 0.50% (maximum 1.5%) of unit price (sl.no 1) quoted by the bidder.	12	Machine Months	0.50
18	For 3rd year The quoted rate (for 1 Machine Month) for this item must be equal to or more than 0.55% (maximum 1.5%) of unit price (sl.no 1) quoted by the bidder.	12	Machine Months	0.55
19	For 4th Year The quoted rate (for 1 Machine Month) for this item must be equal to or more than 0.61% (maximum 1.5%) of unit price (sl.no 1) quoted by the bidder.	12	Machine Months	0.61
20	For 5th Year The quoted rate (for 1 Machine Month) for this item must be equal to or more than 0.67% (maximum 1.5%) of unit price (sl.no 1) quoted by the bidder.	12	Machine Months	0.67

Notes:-

1. Inspection shall be carried out by Owner or its authorized consultant/ TPI at Bidder's Cost.

2. Inlet piping shall be of class 300# (filter, inlet valve and 3-way valve).

3. Delivery location of the Compressors may be changed as per requirement and the same shall be intimated to the supplier before dispatch.

4. Maximum limit to quote charges for Repair & Comprehensive Maintenance for 1 Machine Months shall be 1.5% of unit Ex-works price of item no.1.0, failing which will be liable for rejection of bid.

5. For Items of Operations, Bidder to ensure the minimum wages of Semi-skilled labour/worker for construction industries per day (in Rupees) of respective state/ Central (whichever is higher).

6. Deployment of Bidder personal/Resources for Operation will be as per the direction of Engineer-In-Charge/BGL representative/GA in-charge with prior information of minimum one month. In case of installation of 2 nos. compressor at a particular CNG Station/Mother station i.e. in same premises, EIC may ask the supplier/Bidder to deploy one personnel for operations of both compressors and payment will be done for one personnel/Resource only.

TECHNICAL SPECIFICATION
FOR
GAS ENGINE DRIVEN COMPRESSORS
(1200 SCMH & 600 SCMH)

PREPARED AND ISSUED BY

LYONS ENGINEERING PVT. LTD.

NEW DELHI INDIA

CONTENTS

1.0 GENERAL

1.1 M/s Bhagyanagar Gas Limited, a joint venture of BGL (India) Limited, and HPCL is engaged in development of CNG (Compressed Natural Gas) as fuel to commercial & private vehicles through filling stations in the automobile sector & PNG (piped Natural Gas) to Industrial, household, commercial sector through City Gas Distribution Networks (CGDN) at different Geographical Areas in the country. PNGRB has awarded to BGL the work of development of City Gas Distribution Network for Hyderabad, Vijayawada & Kakinada Geographical Area. Presently, Bhagyanagar Gas Limited is planning to implement CNG & City Gas Distribution Network (CGDN) to supply Natural Gas to domestic, commercial, industrial and automobile consumers distributed over the Geographical Area (GA) of Hyderabad, Vijayawada & Kakinada Geographical Area.

1.2 **SCOPE OF WORK**

This specification along with applicable codes as referred, describe the minimum requirements for design, engineering, manufacturing, assembly, string testing, packaging, supply including forwarding, insurance, custom clearance, handling and unloading at port and delivery & unloading at BGL Gas store /site, re-transportation of the package from the store to the actual site/ station in Hyderabad, Vijayawada & Kakinada as applicable to the foreign and Indian bidders as per price schedule and special conditions of contract, , erection, testing, commissioning, Field performance test of Compressor Package including air compressor and auxiliaries at site, Five years O&M service (one year during warranty period and four years post warrantee period) of the 1200 SCMH and 600 SCMH capacity Gas Engine Driven Reciprocating CNG Gas Compressor Package for suction pressure of 16 kg/cm^2(g) [performance pressure range of 16 to 19 kg/cm^2(g)] with discharge pr. 255 kg/cm^2(g) as required for dispensing CNG to vehicles at various locations in Hyderabad, Vijayawada & Kakinada Geographical Area. Various parts of this specification shall be read in conjunction with each other and in case where the different parts of this specification differ the more stringent requirement shall govern.

Any additional work/equipment or technical requirement not mentioned in the specification but required to make the offered system complete in accordance with the specification and for safe and proper operation, shall be deemed to be included in the scope of work by the Bidder.

The quantities of gas engine driven compressors required shall be as per SOR (Schedule of Rates) cited elsewhere in the tender document.

Delivery Time Schedule of Gas Engine Driven Compressors shall be as follows:

Group No.	Capacity Compressors	Qty.	Time Period
Group A.1	1200 SCMH Gas Engine Driven CNG Compressor Package	Total – 2 Nos	One no. of compressor shall be delivered in 3 months from FOA. For remaining quantity will be delivered after intimation by EIC within delivery schedule
Group A.2	600 SCMH Gas Engine Driven CNG Compressor Package	Total – 1 Nos	One no. of compressor shall be delivered in in 3 months from FOA

1.3 CODES & STANDARDS

The design, construction, manufacture, supply, testing and other general requirements of the compressor package equipment shall be strictly in accordance with the data sheets, applicable API codes, and shall comply fully with relevant National/ International standards, Indian Electricity Act, Indian Electricity Rules, regulations of Insurance Association of India and Factories Act while carrying out work as per this specification.

Any modification suggested by the statutory bodies either during drawing approval or during inspection, if any, shall be carried out by the Bidder without any additional cost and delivery implications.

The following codes and standards (versions/ revisions valid on the date of order) are referenced to & made part of specification:

ISO 13631-2002 : Petroleum and natural gas industries packaged reciprocating gas compressors

PNGRB regulations

OISD 179 -2016 : Safety requirements on compression, storage, handling, refuelling natural gas (CNG) for use in Automotive sector.

ASME B 31.3 -2016 - Process piping

NFPA-37-2015: Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines

NFPA-52: 2016- Vehicular natural gas fuel systems code

NFPA-496-2017: Standard for purged and pressurised enclosures for electrical equipment.

NFPA-68 -2013: Standard on explosion protection by deflagration venting.

NFPA-70 -2017: National electrical code

NFPA 12-2015: Standard on Carbon dioxide Extinguishing system

ASME Sec IX: Qualification Standard for Welding and Brazing Procedures, Welders, Brazers, and Welding and Brazing Operators

Gas Cylinder rules-2016

ANSI, ASTM, NEC, NEMA, Indian Electricity Rules, Indian Explosives Act.

1.4 PRECEDENCE

In case of any conflict among the various documents of this requisition the following preferential order shall govern:

i. Data sheets/drawings

ii. This Technical Specification
iii. Indian Standards / codes applicable
iv. International standards/codes as applicable

Compliance with this specification shall not relieve the Bidder of the responsibility of furnishing equipment and accessories of proper design, material and workmanship to meet the specified operating conditions.

No deviations to the technical requirements and to the scope of supply specified in this enquiry document shall normally be accepted and offers not in compliance to the same shall be rejected summarily. In case a deviation is required due to inherent design of the equipment offered, the Bidder shall list all such deviations at one place giving reasons thereon.

1.5 DOCUMENTS / DATA REQUIRED ALONG WITH BID

Bidder shall necessarily furnish the following along with the bid without which the offer shall be considered incomplete:

i. Proven Track Record Formats duly filled in
ii. Check list duly filled in with regards to scope of supply
iii. Deviations if any to this Technical Specification
iv. Tentative Lay out / key plan/ General Arrangement indicating size of skids, center distance between skids and space required along with maintenance requirements.
(a) Utilities requirements
(b) Electrical Load summary
v. Other details are given in VDR (Vendor Data Requirement).

1.6 SCOPE OF SERVICES

i. Engineering, design and manufacturing.
ii. Procurement of raw materials etc., from sub-vendors.
iii. Preparation of documentation for design, approval by Purchaser / consultant.
iv. Inspection and testing as per T.S.
v. Surface preparation, protective coating and painting as per T.S.
vi. Packaging for transportation to site and supply.
vii. Erection, testing & commissioning as per T.S.
viii. Performance test at site.
ix. Post commissioning annual maintenance with all spares and consumables.

1.7 SCOPE OF SUPPLY FOR EACH COMPRESSOR PACKAGE

Each compressor Package shall be completed with:

i. Lubricated or non-lubricated two throw balanced opposed reciprocating compressor / Trunk Piston Design compressors with lube oil system and cooling system (console type) as required.

ii. Gas Engine as compressor driver.

iii. Gas meter (3 nos.): Mass flow meter (Model CNG 50 with integral local display) based on Coriolis principle of Micro motion, USA with F-series 2700 transmitter at compressor

discharge, F-series with 1700 transmitter at compressor suction and gas engine fuel consumption. Installation and manufacturing of mass flow meter shall be as per AGA-11. While installing special care shall be taken to isolate the mass flow meter from piping vibration. Mass flow meter (Model CNG mass DCI with integral local display) based on Coriolis principle of Endress & Hauser make can also be considered. The mass flow meter at the suction & discharge of compressor shall be W&M approved only.

iv. Instrumentation and control system as specified on data sheets, P&ID including Local panel, Console/Local gauge boards, PLC.

v. Electrical equipment / Instruments indicated in the Compressor package.

vi. Separate flameproof junction boxes for different type of signals like analog, digital signals, alarm, shutdowns, and thermocouples, RTDs etc. for interfacing to FLP local panel. Same is not applicable for direct run cable up to PLC panel.

vii. All cables and accessories shall be as per cl. No. 5.10.

viii. Common structural steel skid for the compressor, gas engine and for all auxiliary systems. Auxiliary systems such as Air compressor, Air receiver, CO2 flooding system, Filters, associated piping, valves, flanges, stud bolts, nuts and supports can be supplied as loose items and shall be assembled by the bidder at site.

ix. Structural supports within the compressor package for all piping, electrical and instruments etc.

x. Inlet twin suction gas filter of filtration level up to 5 micron with oil drain valve & DP gauge and suction line strainer at 1st stage and at other stage if required. A basket strainer of filtration level up to 5 micron with oil drain valve
& DP gauge shall also be installed in the inlet pipe after the isolation valve to be installed by the bidder at the battery limit.

xi. Inter-stage and discharge gas, air cooled heat exchanger.

xii. Separator / Knockout drums/volume bottles with solenoid valve operated auto drains as required. Bypass valves for automatic drain system shall be as per manufacturer's recommendation.

xiii. Priority Panel at Package Discharge as per Priority fill system. All unused priority outlets to be plugged with dummy plugs after isolation valve.

xiv. All interconnecting oil, gas, water, air piping within the compressor package.

xv. All stud bolts and nuts shall be hot dipped galvanized as per ASTM A 153 or equivalent.

xvi. Impulse and pneumatic piping/Tubing for all valves, fittings as specified & required for mounting the instruments.

xvii. NRV at gas suction, final discharge point, LCV and priority panel as required.

xviii. A start- up conical strainer fitted with adequate size mesh at the gas inlet before filter.

xix. Override facility in LCP to fill LCV in priority panel of compressors shall be provided.

xx. Y- type strainers / paper filter, valves, sight flow indicators , check valves, manual drain / traps etc. as required for various auxiliary systems i.e. frame lube oil, cylinder lubrication system, cooling water systems, fuel supply/conditioning system etc.

xxi. Coupling / V-belt / pulleys.

xxii. Copper jumpers for all the flange joints of piping outside the compressor package.

xxiii. Single Acoustic enclosure for both Compressor and gas engine as specified, with two number L.E.L detectors and two UV / IR detectors in enclosure.

xxiv. CO_2 extinguishing system consisting of two cylinders, piping and valves. Inlet and outlet manual & automatic isolating valves.

xxv. Piping from air compressor and CO_2 cylinders up to enclosures at a max. distance of 30m each is in the scope of bidder and shall be treated as part of supply & erection.

xxvi. Each stage outlet Temp. before cooler & after cooler to be displayed on PLC. xxvii. For each compressor, 05 nos. of ESDs (One no. on LCP of compressor, One no. on Soft Starter Panel, One no. in control room, One no. in process area, One no. near dispenser)

xxviii. CCOE / BIS approvals of cylinders used in CO2 flooding system to be submitted.

xxix. Gas flow directions to be marked “Gas In / Gas out “with cylinder stage No. on all the inlet outlet tubes inside compressor package.

xxx. Priority panel outlet connection shall be terminated through ¾ ‘’ OD full flow ball valves with ¾’’ Tube OD end connections except Bus cascade and bus dispenser lines. Bus cascade and Bus dispenser lines shall be terminated through ¾ ‘’ OD full flow ball valves with ¾’’ x 1” expander to connect 1“ tube.

xxxi. Bidder shall furnish a basket strainer fitted with adequate size mesh at the gas inlet before duplex filter. The free area of the strainer element shall be at least four (4) times the internal area of the connecting pipe lines. Flow area in any portion of Basket strainer assembly shall not be less than the pipe cross sectional area. The strainer element shall be with the mesh of 5 micron. Pressure drop in clean condition shall not be more than 4.0 MWC. Wire mesh of the strainers shall be suitably reinforced, to avoid buckling under operation. Strainer shall have screwed blow off connection fitted with a removable plug. The strainer will have a permanent stainless steel tag fixed on the strainer body indicating the strainer tag number and service and other salient data. The size of the strainer and the flow direction will be indicated on the strainer body casting. Thickness of the strainer element should be designed to withstand the pressure developed within the strainer due to 100% clogged condition exerting shut-off pressure on the element.

xxxii. Vendor to provide 1 set of NO/NC contact (NO/NC Rating: 230 V AC, 5A). This contact shall changeover whenever ESD switch is activated.

xxxiii. All gas piping downstream of coalescent filter in compressor discharge shall be of SS 316 only.

xxxiv. The pressure in each bank should be monitored through priority panel with the help of PLC by providing PT in each bank in priority panel

xxxv. Pre alarm to be incorporated in the software before machine trips in predefined values of Pressure & temperatures.

xxxvi. Complete Erection, Testing & Commissioning of compressor packages. xxxvii. Structural supports required for fixing of piping, ESDs & PVC clamps for SS tubes are also included and to be erected at site during installation of the package. Anchor fasteners for air for suction pressure of 16 kg/cm^2(g) [performance pressure range of 16 to 19 kg/cm^2(g)] with discharge pr. 255 kg/cm^2(g) as required for dispensing CNG to vehicles at various locations in Hyderabad, Vijayawada & Kakinada Geographical Area. Various parts of this specification shall be read in conjunction with each other and in case where the different parts of this specification differ the more stringent requirement shall govern.receiver, air compressor, air dryer, CO_2 flooding system, ESD are also included and to be erected at site during installation of the package.

xxxviii. To cater to the normal power supply requirement :-

a) One number of 415 Volt (+/-10 %) 3-phases 4 Wire, 50 Hz (+/-5%) shall be provided by Owner in PDB for Air compressor
b) One number of 240 V (+/- 10%), 1 Phase, 50 Hz (+/-5%) shall be provided by Owner in LDB for Air Dryer.

Bidder shall indicate power / Feeder (KW / Amp) requirement in the offer. Supply, Laying & termination of the cable from the outgoing terminal of PDB/LDB and further distribution is in the scope of bidder.

xxxix. To cater to the UPS power requirement of the compressor for PLC based control panel, one number of UPS (240 +/-1 % V, 50 +/-1 % Hz) (feeder in UPS ACDB) shall be provided by Owner. Supply, Laying & termination of Incoming cable from ACDB to Compressor and further downward distribution is in the scope of the Bidder. Bidder shall indicate power / feeder (KW / Amp) requirement in the offer. Surge protection devices of approved make shall be provided in the control panel.

xl. Supply, Laying and Termination of following cables including all erection accessories like Lugs, Glands etc is included in the scope of Bidder:-

a) Cables from PDB to compressor skid (Length shall be considered as 75 meter).

b) Cables from compressor to hooter and up to ESD push button in control room (Length shall be considered as 75 meter).

c) Cables from compressor to ESD push button near dispenser (Length shall be considered as 200 meter).

d) Cables from compressor to ESD push button in field (Length shall be considered as 150 meter).

e) Cables from PDB to Air compressor (Length shall be considered as 50 meter).
f) Cables from LDB to Air Dryer (Length shall be considered as 50 meter). g) Cables from CO_2 flooding system to Compressor (Length shall becconsidered as 30 meter).

h) Cables from ACDB to compressor skid for PLC based control panel (Length shall be considered as 100 meter).

i) Cables from manual switch/call point of CO_2 flooding system (located in control room) to compressor skid. (Length shall be considered as 75 meter).

Suitable arrangement like cable trays, conduits etc. shall be used for laying the cable.

xli. One number of dedicated Electronic earth pit shall be provided for the PLC based control panel of compressor at a distance of 5 meters form the compressor by Owner. However cabling from the pit to the PLC based control panel and further distribution is in the scope of Bidder. For earthing of the body of the Gas compressor, Air Compressor, Dryer and other components, an earth grid will be provided at a distance of 5 meter from the compressor package. Cabling from the grid to the Gas Compressor, Air Compressor & Air Dryer shall be done through GI strip of 25X3 mm/cable of 1Cx10 sq.mm, Copper conductor whereas for panel it shall be done using Cu Strip of 25x3 mm / cable of 1Cx10 sq.mm, Copper conductor including all accessories like lugs, glands etc is included in the scope of Bidder.

xlii. Comprehensive Annual O&M for five (05) years (one year during warranty period and four years post warranty period) with spares, consumables, man power and lubricants.

xliii. The provision for overhead mounting of cascade [3000 water liter capacity with approximate weight of 6.5 tons] should be there & same should be of enough strength having working space and with ladder arrangement. However Cascade supply and its Mounting on the structure shall be in the scope of purchaser. Structure Stability compliance Certificate of the unit from the manufacturer where cascade will be mounted to be submitted during detail engineering. Cascade drawing will be provided during detailed engineering. However if any modification is required for the structural frame of the compressor on which cascade is to be mounted is to be carried out at site by the bidder during installation of the cascade by the owner.

xliv. Vendor has to provide dedicated Mobile phone & number for each site/compressor. BGL shall not pay any extra charges towards phone & monthly bills.

xlv. Mandatory spares.

xlvi. Foundation bolts and aligning & levelling material

xlvii. Training of 4 persons (2 supervisors + 2 operators) at packager's workshop. The traveling boarding and lodging of Purchaser's engineers shall be borne by PURCHASER. Training module shall span for one week and shall cover the equipment constructional features, operational and maintenance procedures etc.

xlviii. Bidder shall supply One no. Air Compressor with proper Dryer along with Main Compressor package.

xlix. Bidder shall supply Three nos. Flow Meter along with Gas Engine Driven Compressor package.

xlx. Bidder shall supply UPS System of required capacity for smooth operation of Compressors considering the load of two nos. Dispenser.

xlxi. Bidder shall supply Safety Signage and Warning Signage with the packages.

xlxii. Bidder shall consider PCV at inlet line (at Suction) with a range of 0-49 kg/cm^2(g) and outlet pressure of 16-19 kg/cm^2(g) and Filter Skid etc.

xlxiii. Bidder shall handover BGL – One set of special tools like manometer, timing light, UV torch, temperature gun, tachometer, filler gauge and any other special tools and tackles (not mentioned above) after warranty period.

xlxiv. Bidder shall have to maintain the DB level as required by the respective state PCB Norms.

xlxv. Bidder to provide proper training for safe & smooth operation and maintenance of Compressor packages.

xlxvi. Bidder shall provide:

- 9-line Priority Panel at Package Discharge as per Priority fill system for 1200 SCMH Gas Engine driven compressors.
- 7-line Priority Panel at Package Discharge as per Priority fill system for 600 SCMH Gas Engine driven compressors

Note:
Any conflict between the above scope / specification / requirements, most stringent will be followed as per the instruction of EIC.

1.8 EXCLUSIONS

The following are excluded from the scope of the Bidder:

i. All civil works and foundation design. However the Bidder shall furnish all the relevant data for design of compressor foundation. Grouting of equipment on the foundation including supply of material with foundation bolts is a part of erection and is included in the scope of bidder's work.

ii. CNG storage cascade.

iii. Piping between priority panel to cascade/dispenser.

iv. LCV fill trailer panel (For 600 SCMH Compressors only).

1.9 SAFETY

1.9.1 All controls shall operate in a fail-safe mode i.e. failure of any control shall not lead to running of equipment in unsafe mode. Fail safe control shall be available through both software and hardware for all trips.

1.9.2 **Area Classification :** The hazardous area classification Class-I, Division I, Group D as per NEC or Zone I, Group II A/ II B as per IS/ IEC. Certificate from recognized agency to the effect that equipment supplied and/or installed conform to above area classification. All Devices shall meet the requirement for the specified area classification in which they are installed, including instrumentation leads.

1.9.3 All exposed rotating parts shall be provided with adequate guards of non-sparking type.

1.9.4 Drive belt if used shall be of fire retardant and anti-static type.

1.9.5 Piping shall be arranged in a manner so as to provide clear headroom and accessibility within the package. Adequate clearances shall be provided for all the engineered components for O&M point of view.

1.9.6 Package enclosures shall have two IR type L.E.L detectors and two Ultra Violet (UV)/IR fire detectors in each enclosure to cover the enclosures effectively.

1.9.7 All material used in the package shall be flame retardant.

1.9.8 Relief Valves shall be provided at suction and discharge and in between inter stages of compressor with setting as per cl. 11.18.5 of ISO 13631:2002 with R.V. venting as per cl. 11.18.6 of ISO

1.9.9 CO2 flooding system:

The package shall be protected by automatically operated CO_2 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. CO_2 flooding system shall consist of 2 nos. of min 45 kg CO_2 cylinders. However actual size of the cylinder shall be as per compressor enclosure size. Necessary calculation shall be submitted by the bidder during detailed engineering. 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, 2016. Cylinders shall be fitted with actuated Valves, Solenoid valves, limit switches, pressure switch etc. for automatic actuation.

Control philosophy shall be such that:

a. Compressor shall trip on detection of gas at preset level.

b. Compressor shall trip on detection of flame at preset level and automatic discharge of CO_2 gas shall take place simultaneously.

c. On detection of flame by any of the flame detector, the solenoid valve of selected cylinder will open and CO_2 will be flooded into the package.

d. At that time, pressure switch will open (NO) because of pressure in CO_2 header. If the selected cylinder is empty, then pressure switch will operate (NC) and PLC will give signal to open solenoid valve of other cylinder, if flame is detected by flame detector.

e. Even after discharge of selected cylinder, If flame remains detected by flame detector, other cylinder can also be operated after 20 sec (Settable from display) from the time of selected cylinder valve energized irrespective of pressure switch signal.

f. The limit switch provided on the weighing machine will be connected to PLC to indicate that the CO_2 cylinders are full. Both are start permissive for compressor. i.e. if any of the cylinders is empty as sensed by limit switch, compressor will not start. If the operator wants to run the package even if one of the cylinders is empty, the compressor can be run by putting Limit Switch in BYPASS mode for obtaining start permissive.

g. When maintenance override switch put in BYPASS mode to keep the system off during maintenance, CO2 Solenoid valve shouldn't operate, even on detection of flame by any of the flame detector

iv. Facility shall be made to operate the system manually from remote with the help of a switch/ call point and with help of pull down lever on cylinders. In this regard, manual switch / call point shall be provided to operate the desired
(Main / Standby) CO2 cylinder remotely from control room and Pull down lever shall be provided on each cylinder valve for manual operation.

v. Following Selector switches shall be provided :

a) One Selector switch shall be provided in LCP to put Main/Stand by Cylinder in line at the turn of a switch as per requirement.

b) One maintenance override switch shall be provided in LCP to keep the system off during maintenance.

c) One switch shall be provided in LCP to bypass desired limit switch, d) One switch in control room to operate CO_2 remotely

vi. The System shall be designed to operate on 24 V DC supply. FRLS (Fire resistant low smoke) cables shall be used for the wiring of the system.

vii. CO_2 Cylinders shall be provided with explosion-proof fittings.

viii. Online weight (CO_2) loss indication device to be provided to ascertain the health of the CO_2 flooding system.

ix. All installation and instruments shall be compatible for hazardous area Class1, Division 1, Group-D for Methane Gas.

x. Technical specifications, Operation and Maintenance Manual, CCOE Certificate i.e Approval/ Manufacturing certificates for cylinders and cylinder valves, gas detectors, flame detectors, solenoid valves etc. shall be furnished by the supplier along with system. Software and hardware, calibration procedure shall be provided by the supplier along with the supply sufficient enough to handle the system independently.

xi. System shall be tested by the supplier after commissioning at site by creating fire signal and actual discharge of CO2 Gas from the Cylinders. The cylinders have to be refilled by the vendor at no extra cost to purchaser after testing. If the system fails during testing, subsequent testing and refilling would be at vendor's cost.

xii. Warning and Operating instructions to be displayed at equipment as per the statutory/ safety regulations.

xiii. Health status of CO_2 system shall be monitored & controlled through PLC.

2.0 UTILITIES & BATTERY LIMITS

2.1 Utilities

2.1.1 Bidder shall make his own provision for air required for starting the compressor.

2.1.2 Air compressor of capacity 7.5 KW, preferably of IR/KPCL/Elgi/CP make of discharge pressure approx. 16 kg/cm2g with 1000 water litre capacity air receiver with PRV, air dryer along with all accessories and auxiliaries shall be supplied for each CNG compressor package for gas engine starting and instrument air purpose. Air dryer suitable for automatic operation shall also be supplied along with all accessories. The air compressor motor shall be flameproof and will be kept in CNG area. Piping, electrical & instrumentation cabling shall be in bidder's scope as per cl. No. 1.7.

Tapping in the 1000WL air receiver vessel shall be provided with NRV, PRV (set at 7 kg/cm_2 (g)) and isolation valve for CNG dispenser instrumentation line. Air receiver shall be provided with SRV (safety relief valve), pressure gauge and drains. Manual drains and automatic moisture traps/moisture separator cum regulator shall be provided in the system.

2.1.3 Tapping from air receiver/dryer shall be provided as follows;

a. For dispenser: One ½" tapping with isolation valve after PRV.

2.1.4 Cooling water is not available as utility and the package shall be provided with self- sufficient cooling water system for Compressor, as required, with makeup tank. However cooling water for makeup tank is available.

2.1.5 All electrical and instrumentation terminals shall be as specified.

2.1.6 Electric power shall be made available by Owner as described in scope of supply.

2.2 Battery limits

2.2.1 Gas Inlet shall be brought out to a distance of 10m from the package edge and terminated in nozzles with isolation valves having flange connection. The piping along with structural supports, copper jumpers for all the flange joints from battery limit to Compressor package shall be in bidder's scope. Piping from air compressor to air receiver and CO2 cylinders up to enclosures at a max. distance of 30m each is in the scope of bidder and shall be treated as part of supply & erection. All the SS tubing shall be supported properly with PVC clamps only. All the drain pipes of air compressor, air receiver, air dryer shall be terminated to the nearest drain properly.

2.2.2 As and where specified on the data sheets 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 3.0 m at package roof.

2.2.3 All drains from different process equipment, distance piece and packing (if applicable for bidder's design) shall be manifolded and terminated at single point for customer interface duly flanged with isolation valve.

2.2.4 The Bidder work shall commence from Outgoing terminals of PDB/ACDB/LDB (PDB/ACDB/LDB is in the scope of Owner) .Downstream distribution arrangement from the PDB to the Online Compressor is in the scope of Bidder.

2.2.5 The Bidder work shall commence from the cabling from electronic earth pit & earthing main grid at a distance of 5 meter from the compressor package. Downstream distribution is in the scope of Bidder.

3.0 EQUIPMENT QUALIFICATION CRITERIA

3.1 The Gas Compressor model offered shall be from the existing regular manufacturing range of the Gas Compressor manufacturer. At least one identical or higher capacity compressors must have been manufactured, tested and supplied from the proposed manufacturing plant in the last seven years. And the supplied compressor must have been operating satisfactorily in this field for a period of 8000 hours as on the bid due date.

3.2 The Gas Engine model offered shall be from the existing regular manufacturing range of the gas engine manufacturer. At least 1 identical or of higher capacity engine must have been manufactured, tested and supplied from the proposed manufacturing plant in the last seven years from bid due date and the supplied engine must have been operating satisfactorily in any field for a period of 8000 hours as on the bid due date.

4.0 BASIC DESIGN

4.1 General

4.1.1 The Compressor shall meet all the technical requirements as specified in:

i. Data Sheets

ii. Technical Specification

iii. Code and specification (as applicable) API-11P, OISD 179, NFPA 37, NFPA 52, ANSI, ASTM, NEC, NEMA, Indian Electricity Rules and Indian Explosives Act are referenced to & made part of specification.
Compressor, engine and auxiliaries design shall be in conformity with API 11P, second edition

4.1.2 Minimum Three stage Compressor configuration is envisaged. Gas composition given under Design Case shall be used for Compressor selection, sizing and performance guarantee estimates. However compressor shall be suitable for continuous operation with the indicated gas composition range and operating parameters given in the data sheet.

4.1.3 Suction line pressure may vary from 16 kg/cm²G to 19 kg/cm²G with discharge pressure at 255 kg/cm²G. A suction pressure regulator shall be installed to limit the suction pressure to 19 kg/cm²G. The suction pressure of 16 kg/cm²G shall be used for compressor sizing/ selection.

4.1.4 Bidder's offer shall be based on firm and final compressor models on which basis the offer shall be evaluated. All bidders shall take full cognizance of this matter before submitting the bid.

4.1.5 Note that the pressures given on the data sheet are at the compressor package battery limits, bidder shall consider all pressure losses at suction, interstage and discharge at the specified capacity (with no -ve tolerance) for compressor/engine and indicate the same on the data sheets. No venting of the gas is allowed at any point during operation.

4.1.6 he compressor Driver shall be suitable to start the compressor against the stabilized pressure (30 Kg/cm²g) of the system. A gas recovery vessel of suitable capacity shall be provided to collect the gas of 1st, 2nd & 3rd stage of compression. The operating pressure of gas recovery vessel shall be

35 kg/cm²g maximum. No venting of gas is allowed.

4.1.7 The compressor driver shall be capable of running the compressor under loaded condition with each stage pressurized to its respective specified pressure and final pressure upto PSV set pressure.

4.1.8 Near Zero Gas Loss compressor package design is envisaged. The Compressor packages with gas loss in excess of 1% shall not be accepted

4.2 Allowable speeds, temperature and vibration levels

4.2.1 The linear piston speed shall be limited to 4 m/sec for non-lubricated and 4.5 m/sec for lubricated compressors.

4.2.2 The maximum discharge gas temperature for each stage shall be limited to 150°C.

4.2.3 Compressor maximum vibrations at cylinders and at frame shall not exceed 10 mm/sec and 5 mm/s respectively at unfiltered peak velocity. The Bidder shall provide structural support for all the parts within the package so that these levels can be achieved.

4.3 Piston Rod, Bearings and Cross Heads

4.3.1 The surface hardness of Rockwell C 50 minimum is required on piston rods in the areas that pass through the packing. Rolled threads shall be provided on the rods with thread relief area as polished.

4.3.2 Crosshead shall be manufacturer standard material and designs. Adequate openings for removal of the crossheads shall be provided.

4.3.3 Piston rod and cross head pin loading at any specified operating condition at the relief valve set pressure shall not exceed 80% of the maximum design rod load of the offered compressor. Rod loads shall have sufficient reversals in direction for all specified operating conditions including RV Settings and part load operation.

4.3.4 Frame rating as published in catalogues of the offered compressor model shall be min 1.1 times the required rating corresponding to max severe operating conditions taking into account temperature correction factor.

4.4 Packing Cases and Pressure Packing

4.4.1 All oil wiper, intermediate seal and gas cylinder pressure packing shall be segmental rings with corrosion resistant garter springs. The pressure packing case shall be provided with a common vent and drain below the piston rod piped to the outside of the distance piece. However if pressurized crankcase type design is used, packing vent and drain shall not be provided.

4.4.2 Packing vent piping inside of the distance piece shall be designed for the maximum allowable working pressure of the cylinder.

4.5 Compressor Crankcase Lubrication system

4.5.1 The crankcase lubrication shall be pressurized system, with a main oil pump driven directly by the compressor shaft.

4.5.2 If required the Bidder shall provide manually operated/ air/electric motor driven pre lubrication

pump. Crankcase shall be fitted with lube oil temp & oil level sight glass. The maximum and minimum operating levels shall be permanently indicated.

4.5.3 Heating shall be provided for reservoir if applicable for the bidder's design of compressor when the minimum ambient temperature is less than the Bidder's required minimum start up temperature.

4.5.4 Heater besides meeting the area classification requirements specified in the Tender shall be star connected if designed for operation on 3-phase (4 wire), 440V, 50 Hz supply.

4.6 Distance Pieces

4.6.1 Distance piece as per ISO 13631-2002 with cylinder side compartment vented to safe location is specified. Distance piece as per manufacturer's standard design which is used in the earlier supplied successfully running packages is also accepted.

4.6.2 Distance pieces shall be provided with gasketted, solid covers and shall be suitable for a minimum differential compartment pressure of 1.75 kg/cm²g.

4.7 Cylinder and Packing Lubrication

4.7.1 Divider block type lubrication system/Single plunger per point force feed mechanical lubricator shall be provided for lubrication to compressor cylinders. Block- distribution lubrication systems shall be complete with no-flow shutdown, rupture relief discs, check valves, filter, common sight glass and carbon steel or austenitic stainless steel tubing. For pump-to-point lubrication systems, a sight indicator for each point, check valves and carbon steel or austenitic stainless steel tubing shall be furnished.

4.7.2 Lubricators shall be driven by crankshaft and bidder shall highlight any pre lubrication requirements of the cylinders and the method of achieving the same.

4.7.3 For pump-to-point lubrication systems, Lubricators shall have a sight flow indicator for each lubricator point and a stainless steel double ball check valve shall be provided at each lubrication point.

4.7.4 Digital no flow timer shall be provided to stop the compressor in case of loss of cylinder lubrication.

4.7.5 Lubricator reservoir capacity shall be adequate for 100 Hrs of normal flow, and shall be equipped with low level alarm.

4.7.6 Bidder along with the proposal shall furnish the recommended lubricating oil type, International Grades & Specification (HP make Lubricants mandatory) along with their quantity and frequency of change. The recommended oil shall be compatible with gaskets, O-rings, seals, packing, lubricator parts and other parts coming into contact.

4.8 Cooling System

4.8.1 Compressor Cylinder

Compressor cylinders must be air-cooled only. Water cooled cylinders are not acceptable. The CW shall be cooled by an air-cooled heat exchanger.

4.8.2 Inter / After Gas Coolers

Air-cooled inter-stage and final stage discharge coolers shall be provided which shall limit the gas temperature after the after cooler to 50₀C. For calculating the surface area of the air cooler, the ambient air temperature of 44^0C and 80% RH shall be considered. Cooler design shall be on the basis of 20% excess capacity than required corresponding to suction pr. of 19 kg/cm2(g). Gas sections of coolers shall be designed as per API-661 requirements. Vibration switch shall be provided on the heat exchanger to trip the compressor on high vibration limit. Bidder shall indicate vibration level in the offer. For cooling of the Heat Exchangers a cooling fan to be provided inside the enclosure(s). Cooling system shall be preferably installed on the same skid as the compressor due to space constraints. Bidder shall submit cooler sizing calculation for review.

4.9 Separators & Oil Removal System

4.9.1 Carbon Steel separators / KOD/volume bottles with auto drain system shall be provided for the capacity as required.

4.9.2 All pressure vessels shall be designed as per ASME VIII Div 1 or equivalent.

4.9.3 All vessels including pulsation dampers shall be fully (100 %) radiographed as per ASME VIII UW (a) or equivalent.

4.9.4 Minimum design temperature for separators/KOD/volume bottle shall be 71OC and minimum design pressure shall be maximum operating pressure plus 15% for inter- stages and plus 10% for final stage.

4.9.5 NRV shall be provided on suction, 1st stage, 2nd stage, 3rd stage separators /KOD /volume bottle drains.

4.9.6 Gas recovery system: Bidder shall provide blow-down tank to act as: A buffer tank during start-up.

i. Gas flow dampener during compressor operation

ii. Surge tank for depressurization of each of the compressor stage piston cylinders during shutdown.

iii. Blow-down tank size should be to manufacturer's design standards. The gas recovery vessel shall be provided with pressure relief valve and necessary instrumentation to avoid cold flaring of gas.

iv. Capacity shall be suitable to prevent any venting.

v. Suction damper and gas recovery vessel shall preferably not be combined and one pressure regulator with isolation valve shall be provided to connect gas recovery vessel with compressor suction.

vi. If suction damper and gas recovery vessel are combined, pressure regulator after gas recovery vessel will not be allowed due to high pressure drop during compressor operation.

vii. One vent line from gas recovery vessel with double isolation valves shall be provided

4.9.7 All separators / KODs/volume bottles shall be provided with 3 mm corrosion allowance.

4.9.8 Oil from all drains shall be collected into the oil recovery pot. Oil recovery pot shall be provided with manual drain arrangement. Capacity shall be min. 15 water liter.

4.9.9 Coalescent super fine filters (preferably two stage) with CE mark/ Third party certification for removal of liquid (e.g. water & oil) and solid particles down to 0.1 microns out of compressed natural gas shall be provided. Residual Oil Contents shall be less than 1 PPM. Automatic drains with On-off valve connected to Gas recovery vessel shall be provided. The filter should be sized to flow min. 200% of the flow at suction pressure of 19 kg/cm2g. However mechanical design shall be based on safety set pressure.

4.10 Pulsation, Vibration Control and Analog Study

4.10.1 Suitable arrangement for interstage pulsation damping shall be provided in confirmation to ISO 13631-2002.

4.11 Gas Engine

4.11.1 The gas engine offered shall be gas fired 4-stroke, spark ignited type. The integral gas engine & compressor type design is not acceptable.

4.11.2 The site rating of engine shall be max of the following two conditions;

a. 110% of greatest BKW required by compressor including cooling fan , other auxiliaries and the losses at any of the compressor operating conditions corresponding to suction pr. of 16 kg/cm2(g), 17.5 kg/cm2(g) or 19 kg/cm2(g) with suction valve fully opened and discharge pressure 255 kg/cm2(g) for MR item no. 1.

b. 105% of greatest BKW required by compressor including cooling fan , other auxiliaries and the losses at any of the compressor operating conditions corresponding to suction pr. of 16 kg/cm2(g), 17.5 kg/cm2(g) or 19 kg/cm2(g) with suction valve fully opened and discharge pressure at relief valve (RV) set pressure for MR item no. 1.

4.11.3 The site rating of engine shall be worked out considering the derating specified under the latest edition of British Standard 5514/ISO 3046 and deducting the power absorbed by all the engine driven auxiliaries, as conceived by the Packager. The site rating of engine shall be based on 44.0oC ambient temperature, RH 80% and an altitude of 900 meter taking design case gas composition as specified, the site rating so arrived shall be suitable for the maximum Compressor BkW as arrived at and which can be applied 24 Hrs a day seven days a week with a overrating capability of up to 10%. Successful Bidder is requested to submit site-rating calculation along with de-rating calculation. Note that the Design Gas specified for the compressor shall be used as engine fuel.

4.11.4 All the auxiliary equipment including the cooling fans shall be engine driven.

4.11.5 The engine shall be provided with the shielded ignition system of breaker less type, low-tension solid state having vapour proof enclosure with a high-tension coil at each power cylinder. The spark plug shall be shielded and all low-tension wiring shall be enclosed in grounded steel conduits. But the spark plug connecting cables shall be enclosed in grounded, metal shielded flexible conduits.

4.11.6 Constant speed hydraulic/electronic governor preferably of WOOD WORD make adjustable for speed setting over the operating range.

4.11.7 The engine silencer shall be residential type mounted on the roof of the engine enclosure.

4.11.8 Bidder shall supply fuel gas conditioning system to condition the fuel gas so as to make it

suitable for use in offered gas engine. The fuel gas-conditioning system shall mainly consist of fuel gas filter, interconnecting piping, fittings, valves, pressure regulator, safety valve, mass flow meter and necessary instrumentation etc as required shall be incorporated by the bidder.

4.12 Enclosure of CNG Compressor Package

4.12.1 The maximum allowed temperature within the enclosure shall be 5°C above ambient temperature. Adequate ventilation fans/suitable arrangement shall be provided to meet the above and also to account for heat dissipation of the coolers.

4.12.2 The compressor package shall consist of single enclosure for Compressor and gas engine. The equipment shall be mounted on one common skid. The Enclosure to restrict maximum noise level to 70 dB (A) at 1 meter from the enclosure.

4.12.3 Enclosures shall be weather proof and shall be provided with ventilation system.

4.12.4 The enclosures shall have doors for normal access for ease of maintenance of all the components.

4.12.5 All the pressure, temperature, lube oil pressure, coolant temperature shall be visible from outside of enclosures though gauge panel.

4.12.6 Enclosures shall have internal flame proof lighting arrangement.

4.12.7 The Compressor shall be located inside an acoustic enclosure. All Coolers, Knock out Drums/Scrubbers/volume bottles, Cooling System, lubrication system along with interconnecting piping shall be inside an enclosure. Enough headroom shall be made available for easy access and maintenance of all equipment.

i. Components such as pressure gauges, temperature, pressure switches, filter automatic ball valves, safety valves etc., which require in-situ adjustment, maintenance and reading, shall be easily accessible.

ii. Tray/Conduits and tubing shall be arranged in orderly and systematic manner and shall be routed neatly to enter the back of display or monitoring panels

iii. Routine service item such as, but not limited to, crank case oil filters, inlet and outlets gas filters and drive belt shall be located to facilitate easy one- man servicing.

iv. One person should be able to access crank case oil inlet and drains to allow addition or drainage of oil without removing panels or adjacent components and without the need of the pump.

v. Items which must be operated & monitored during operation shall be readily accessible without opening the door.

vi. Suitable gradients shall be provided on the enclosure roof for rain drainage and to avoid water pockets.

vii. Communication/Control cables shall be routed through Cable Trays/conduits.

4.13 Piping

4.13.1 All gas piping shall be designed, fabricated & tested in accordance with ANSI B 31.3.

4.13.2 Low pressure Gas piping shall be seamless carbon steel manufacturing in accordance with ASTM A - 106 Grade B. All Gas piping shall be flanged connections. Pipe wall minimum thickness shall be in accordance with Table 4 of ISO 13631:2002.

4.13.3 All rigid piping, tubing & other components of compressor package shall be designed for full range of pressure & temp and loading to which they may be subjected with a factor of safety of at least 4 based on minimum specified tensile strength at specified ambient temperature.

4.13.4 All rigid piping shall be continuous between their respective components & free of connections except welded joints. All high pressure joints shall be welded unless otherwise not feasible.

4.13.5 The instrument air tubing material shall be minimum SS304 inside the compressor from main distribution header to instruments.

4.13.6 All high-pressure gas piping shall be of SS 316 material with double ferrule fittings and 2/3 way valves. Material of tube shall be as per ASTM A269.

4.13.7 Bidder shall furnish a start-up conical strainer fitted with adequate size mesh.

4.13.8 Pressurized lubricating oil lines downstream of the filter (with the exception of cast- in-frame lines or passages) shall be made of austenitic stainless steel. For either tubing or piping, bends shall be used to minimize the number of fittings wherever possible. Steel fittings shall be furnished with stainless steel tubing. Pressure piping downstream of oil filters shall be free of internal obstructions or pockets (such as those created by socket weld fittings) that could accumulate dirt at pipe joints. Non- consumable back-up rings and sleeve-type joints shall not be used. Other piping fittings shall be of the socket-weld or butt-weld type. When butt welds are necessary, such precautions as internal grinding of joints and use of gas tungsten- arc welding for the first weld pass shall be taken to prevent weld splatter inside the lines. After fabrication, oil lines shall be thoroughly cleaned and preserved. In addition, carbon steel piping shall be pickled and passivated.

4.13.9 External drain & vent piping shall be Carbon Steel and not less than 1" nominal size. However, all the internal drains/ vent connections shall be SS 316 tube as per ASTM A269.

4.13.10 Mercaptan / THT / (80% TBM+20%MES) Spotleak 12 ppm dosing is envisaged hence all materials coming in contact with gas shall be compatible to such gas with Mercaptan / THT / (80% TBM+20%MES) Spotleak 12 ppm dosing and be of compressor manufacture's standard. The use of SA 515 material is prohibited.

4.13.11 All piping after coalescent filter at compressor discharge shall be of SS 316.

4.13.12 All stud bolts and nuts shall be hot dipped galvanized as per ASTM A 153 or equivalent.

4.13.13 The instrument air header & CO2 piping upto compressor enclosure shall be seamless CS.

4.13.14 All low pressure and high pressure gas piping joints fabricated at site / shop shall be 100% radiographed after welding.

4.13.15 Design of piping systems shall achieve the following:

i. Proper support and protection to prevent damage from vibration or from shipment, operation and maintenance;

ii. Minimize loads on the nozzles of cylinders and pulsation suppression devices;

iii. Avoidance of pipework bending forces and/or introduction of adequate flexibility to minimize stress;

iv. Good accessibility for operation, maintenance and cleaning;

v. installation in a neat and orderly arrangement adapted to the contour of the machine and not obstructing access openings;

vi. Elimination of air pockets;

vii. Complete drainage through low points without piping disassembly; Proper provision of drainage of condensates from knock out drum / vessel shall be provided with gravity levels and to minimize gas loss during this operation cycles (manual/auto mode).

viii. Elimination of low points in the inlet process piping including recycle/by- pass piping that could trap liquid;

ix. Use of pipe clamps on all gas piping and on all piping DN 50 (2 in) and larger;

x. supports shall not be welded directly to gas piping.

xi. Following certificates have to be submitted for piping fabricated at Site & shop

a. Electrode qualification test procedure
b. Proposed Welding procedure specification with impact test c. Electrode qualification test results
d. Procedure qualification test results and final WPS
e. Welder's qualification test

4.14 Coupling

4.14.1 V-Belt drive up to 150 KW gas engine rating is acceptable. Direct drive shall be offered by the Bidder if power requirement is > 150 KW. Gear drive is not acceptable.

5.0 ELECTRICS & INSTRUMENTATION CONTROL:

5.1 Starter/Control Panel/ Control philosophy

5.1.1 FLP Panel shall be complete with all FLP equipment like start and stop push buttons, power on and fault indication lamps, fault reset button. All necessary timers and intrinsically safe relays to control the system on an automatic starting and stopping basis shall be provided. The compressor package control system shall be designed for unattended operation in automatic mode and in case of any fault it will go in a safe mode.

5.1.2 Compressor Package shall be provided with a PLC based LCP, which shall be mounted on the package enclosure. PLC shall be housed inside flameproof IIA/IIB (Ex'd') enclosure. Local operator panel shall also be provided on the flameproof enclosure. All the interlock, monitoring

and controlling of the CNG compressor package shall be done through PLC based control system which will be of proven type and make. PLC hardware shall be in accordance with IEC-61131-2 and PLC programming shall be made only in ladder diagram, however PLC shall be capable to convert programmed in flow chart, functional block diagram, structural text etc in accordance with IEC-61131-3. PLC shall be provided with display & scrolling facilities to view process & machine parameters. All source & object codes including logic flow chart, ladder diagram etc is to be furnished by the Packager during detailed engineering. Provision shall be made that the same can be viewed on client's Laptop.

5.1.3 PLC shall be suitable for recording of compressor parameters as indicated in instrumentation and all other parameters that are recommended by the compressor manufacturer for recording on hourly basis for the last 24 hours.

The units of measurement for flow shall be Kg/hr, for pressure shall be Kg/cm2 (g) or and for temperature shall be degree C.

5.1.4 PLC shall be of modular in construction with redundant CPU with EEPROM, redundant interface module, redundant network switch, redundant power supply for CPU and HMI, redundant power supply for load, non-redundant I/Os, communication cards for connecting mass flow meter, communication card

card/port for future SCADA connectivity. Diagnosis feature shall be available in CPU and I/O used in PLC. Mounting of PLC components such as CPU, HMI, I/Os in one JB and power supply relay barriers/isolators, fuses, MCB, electrical earthling bus bar in other JB.PLC components / system shall be tropicalised, adopted with complete wiring and necessary terminals. Wiring to be color-coded with cross printed ferruling in position. Mass to volume calculation is not required; however, bidder shall provide a soft tag for entering standard density up to 2 decimal point with the help of external push button in PLC for converting mass flow rate to volume flow rate. PLC shall be configured as a remote terminal unit of supervisory computer and data acquisition system complete with Ethernet Port / RS 485 (MODBUS TCP/IP) shall be readily configurable for communication over MODBUS TCP protocol. All the parameters on the PLC shall be configured to be available for SCADA. Providing necessary support and assistance during integration of the compressor with the SCADA is in Bidder's scope. PLC shall be capable of carrying out on line routines for at least ten separate loops without affecting the scan, cycle & up dating time etc. PLC programming shall be made only in Ladder Diagram, with comments in English for each Rung.

5.1.5 The PLC System offered shall be supplied with monitor and shall be capable of:

i. Compressor Control & Emergency Shut down ii. Fire and gas detection and monitoring

iii. Graphics, Data acquisition, monitoring & logging, viewing, modifying set point and range fall process parameters for which transmitters are provided.

iv. Record the last 20 Alarms of abnormal operations on separate page. v. Viewing

process diagram with on line data on line.

vi. Viewing trend of min. 10 critical parameters.

vii. Shall have historical as well as event recording system for atleast last 200 events

viii. PLC shall be capable for display of flow meter data for flow rate and flow totalizer (i.e. Gas Suction, Gas Discharge, Gas consumed by the engine), compressor running hour etc. in following manner:

a. Shift wise (for 3 shift operation i.e. 06:00-14:00, 14:00-22:00 & 22:00-06:00) - shall be available for at least last 96 hours with date stamping.

b. Daily basis- shall be available for at least last 31 days with date stamping

The above data will be viewed / analyzed offline (during shut down of compressor) or online through dedicated SCADA port (Ethernet / RS 485) on client's Laptop / Local PC. Necessary software for downloading data and processing as define above shall be provided. 10 Meter cable with suitable adaptor (if required) shall be provided.

5.1.6 The compressor package control system shall be so designed that the first item to go into alarm condition shall lock out to indicate the cause of the trip though the cause of the trip may have disappeared. The lock out condition shall be manually reset. Where three bank cascade has been envisaged; in auto mode, compressor shall start automatically in case high bank storage pressure falls below 220 kg/cm2(g) and stop as soon as pressure in all three banks of stationery cascade and mobile cascade reaches 255 kg/cm2(g). Where only one bank cascade has been envisaged; in auto mode, compressor shall start automatically in case storage pressure falls below 220 kg/cm2(g) and stop as soon as pressure in cascade and mobile cascade reaches 255 kg/cm2(g). In manual mode the compressor shall also stop at 255 kg/cm2 (g) pressure. The priority fill system (In Bidder's scope) shall ensure the filling of vehicle, storage cascade and mobile cascade in correct sequence. Control system shall be designed such that in case of any fault, discrepancy or abnormality, it will go in safe mode. All controls shall be made in failsafe mode & failure of any control shall not lead to operation of equipment/ system in unsafe condition. In case of fault, a warning hooter shall operate, the sound of which should be audible at distance of at least 15 meter. Further the fault alarm and emergency stop PB shall be duplicated in the CNG station control room. Acknowledgement/resetting of fault shall be possible only from compressor panel. There shall be red and green indication at top of enclosure to indicate code no of alarm/trip in red color. List of alarm with code no shall be indicated on SS plate and to be fixed at compressor enclosure. Emergency stop PBs shall be mushroom head turn lockable type. Once the fault is acknowledged or compressor is under normal maintenance, the valves of priority panel shall take the position so that gas available in the stationary CNG storage cascade can be dispensed.

5.1.7 The points to be monitored for downstream of priority panel shall be:

i. Pressures in each bank of stationary storage cascades.
ii. Pressure at outlet for dispenser.
iii. Pressure at outlet for mobile cascades.
iv. Control Air Pressure
v. Indicators, Alarms and Trips as per Equipment Data Sheets
vi. Pre-alarm to be incorporated in the software before machine trips in predefined values of Pressure & temperatures

5.2 Calibration certificates required for all instruments such as Mass Flow Meter, Pressure transmitters, Pressure gauges, Temperature gauges, Temperature transmitters, Gas detectors, Flame detectors etc.

5.3 Vendor has to calibrate Pressure & Temperature instruments within 1month of compressor commissioning or before Performance Guarantee testing.

5.4 Training to BGL team at site - functional & operational with PLC& instrumentation system. Training program and the procedure shall be provided for training at site.

5.5 The priority fill systems: The priority panel shall ensure the filing of vehicle, storage cascades & LCV in correct sequence. The priority fill system shall ensure 200- kg/cm2g pressure in CNG dispenser outlet port. Design of priority fill system shall be aimed to achieve maximum flow rate through combined flow from compressor and cascade arrangement. All priorities shall be with full bore ball valves having high CV. Bidder shall indicate flow rate achievable through proposed priority fill system design. All tubing and valves shall be ¾" size for 1200 SCMH compressor. One isolation valve at outlet of each line shall be provided. After isolation valve tube dia for bus dispenser and bus cascades shall be 1" OD. Sheeting work of priority panel shall be SS construction. All the pneumatic tubing for solenoid of priority shall be of SS 304 only. All unused priority outlets to be plugged with dummy plugs after isolation valve.

Nos. of priority panel required shall be as per SOR/MR.

The details for various configuration of priority panel for different type of CNG stations including priority fill panel design to deliver the CNG shall be as follows:

5.5.1 TYPE –1 FOR MOTHER STATION: 9 LINE :

A: When compressor is running

Priority no. one : Car dispenser Low bank
Priority no. two : Car dispenser Medium bank
Priority no. three : Car dispenser High bank
Priority no. four : Bus dispenser (Single bank filling)
Priority no. five : High bank of storage cascade
Priority no. six : Medium bank of storage cascade
Priority no. seven : Low bank of storage cascade
Priority no. eight : Bus cascade (Single bank filling)
Priority no. Nine : Mobile cascade mounted on Light commercial vehicle (single bank filling).

B: When compressor is not running:

When the compressor is not running, the valves of priority panel shall take the position so that gas available in the stationary car cascade and bus cascade can be dispensed. The priority of dispensing from car cascade shall be as follows;

Priority no One : Low bank of storage cascade
Priority no Two : Medium bank of storage cascade
Priority no Three : High bank of storage cascade

5.5.2 TYPE –2 FOR ON LINE STATION: 8 LINE :

A: When compressor is running

Priority no one : Car dispenser Low bank
Priority no two : Car dispenser Medium bank
Priority no three : Car dispenser High bank
Priority no four : Bus dispenser (Single bank filling)
Priority no five : High bank of storage cascade
Priority no six : Medium bank of storage cascade
Priority no seven: Low bank of storage cascade
Priority no eight : Bus cascade (Single bank filling)

B: When compressor is not running:

When the compressor is not running, the valves of priority panel shall take the position so that gas available in the stationary car cascade and bus cascade can be dispensed. The priority of dispensing from car cascade shall be as follows;

Priority no One : Low bank of storage cascade
Priority no Two : Medium bank of storage cascade
Priority no Three: High bank of storage cascade
Priority no Four : Bus cascade (Single bank filling)

5.5.3 TYPE –3 FOR ON LINE STATION: 6 LINE :

A: When compressor is running

Priority no one : Car dispenser Low bank
Priority no two : Car dispenser Medium bank
Priority no three : Car dispenser High bank
Priority no four : High bank of storage cascade
Priority no five : Medium bank of storage cascade
Priority no six : Low bank of storage cascade

B: When compressor is not running:

When the compressor is not running, the valves of priority panel shall take the position so that gas available in the stationary car cascade and bus cascade can be dispensed. The priority of dispensing from car cascade shall be as follows;

Priority no One : Low bank of storage cascade
Priority no Two : Medium bank of storage cascade
Priority no Three : High bank of storage cascade

5.5.4 TYPE –4 FOR ON LINE STATION: 7 LINE :

A: When compressor is running

Priority no one : Car dispenser Low bank
Priority no two : Car dispenser Medium bank
Priority no three : Car dispenser High bank
Priority no four : Bus dispenser (Single bank filling)
Priority no five : High bank of storage cascade
Priority no six : Medium bank of storage cascade
Priority no seven : Low bank of storage cascade

B: When compressor is not running:

When the compressor is not running, the valves of priority panel shall take the position so that gas available in the stationary car cascade and bus cascade can be dispensed. The priority of dispensing from car cascade shall be as follows;

Priority no One : Low bank of storage cascade

Priority no Two : Medium bank of storage cascade
Priority no Three : High bank of storage cascade

5.6 Human machine interface (HMI)

5.6.1 HMI shall be provided with touch screen and operating system software **(with minimum all the features of operator panel of model MP277B/TP1200 COMFORT min.10" graphic display of Siemens/Schneider)**, software's for interlocking, monitoring and control. All operational buttons shall be on touch screen except the Emergency stop button. Touch screen display system shall be weather proof to IP65. This should be provided in the flame proof panel with HMI mounted on the door of the panel. The HMI screen shall be backside of the toughened glass. During running of the compressor the HMI should be assessable through the external push button provided on the panel. The PLC shall be interfaced with SCADA in future. All the parameters on the PLC shall be available on the HMI. Bidder shall provide Application program for PLC, HMI on LCP (licensed one set) along with all interfacing adaptors and cables. Bidder shall also provide one set of source & object codes for PLC, HMI on LCP (in both forms, hard & soft).

5.7 Emergency Shut Down

5.7.1 Bidder shall provide emergency shut down (ESD) system in the control room as well as locally mounted near the Compressor and dispenser. Fail-safe system shall be designed and incorporated to isolate cascade storage from dispenser, stop compressor, and isolate the compressor suction and discharge lines. ESD switch shall have to be manually reset to restart the compressor package again. ESD shall activate either on pressing emergency push button (red button) or on fire detection. Red ESD button (05 nos.) shall be located near Process Area Fencing, one on compressor, control room, one no. near dispenser.

In addition to the above, separate ESD push button shall be provided in LCP other than the packaged emergency push button. This push button shall be directly wired with fuel shut off valve and engine ignition grounding system by passing PLC /engine governing system. On pressing the button it shall immediately cut off the fuel supply and ground the ignition system for immediate stop of the machine. A spare contact from the emergency push button shall be connected in PLC to initiate other auxiliaries shut down and indicate alarm as **"hard ware emergency push button press".**

5.8 Electric and control panel :

5.8.1 The electrical panel shall be flameproof construction and located on the compressor package. The electrical power supply distributions panels, switchgear panels and starter panels shall have flame proof construction. There shall be FLP push button panel available at the compressor skid suitable for hazardous area classification. The switchgear shall have one incomer and adequate number of outgoing feeders. The incomers shall be provided with suitably rated MCCB/MPCB, indication lamps etc. Adequate number of MCB feeders for control and lighting shall be provided. Bidder shall furnish single line diagram of the panel with the bid.

5.8.2 Push button for fault accept, fault reset, ESD, comp start, comp stop, scroll up, scroll down, enter, increment, decrement, back, hooter test, 05 nos. spares shall be provided.
Switch for auto manual selection, CO2 cylinder main /CO2 cylinder standby, 415V
AC supply on/off, 230 VAC supply on/off, tube light on/off and 2 nos spares shall be provided. Lamp for 230 VAC on, 24 VDC PLC supply on, ready to start, running & trip and 5 nos spares shall be provided

5.8.3 Electrical Power supply for electrical control panel:

All electrical equipment shall be suitable for the following supply conditions.

i. **Power supply for electrical control panel:** Electrical operating voltage: AC, 3 phases, 415 + 10%V, 50 + 5%Hz. Bidder to note that all control electronic / electrics shall be capable of withstanding voltage fluctuation specified.

ii. **Power supply for PLC based Control Panel** : Electrical control voltage: 230+5 % V, 50 +1 % Hz. Control supply through UPS shall be provided by the purchaser

All auxiliaries and, power contactors in electrical panel etc. shall have operating voltage of 230 volt AC.

5.8.4 List of Documents: (To be provided with each package).

i. Priority Panel & Air compressors OEM Tests Certificates.
ii. Instrument Calibration certificates: GD, FD, TG, TT, PT, PG, PS, VS, MFM, PCV+SSV.
iii. SRV, Pressure vessel Test certificates
iv. PLC Program, PLC Display Program (Password Free)
v. Software for communication.
vi. Communication Cable & Adaptor.
vii. Logic Diagram/ Ladder Diagram (Comments in English).
viii. Alarm / Shut Down List with set points.
ix. Operating / Control write up

5.9 FLP Electric Motor for Air compressor

a)	Type of drive	Totally enclosed fan Cooled(TEFC) high efficiency (IE2) as per IS 12615:2011, IS : 2148 , IS 4691 and other relevant standard
b)	Protection	By bidder
c)	Insulation	Class “F” with Class “B” temperature rise
d)	Mounting	Horizontal foot mounting
e)	Specification Standard	IS 12615:2011, IS : 2148 , IS : 4691
f)	Supply Voltage (assumed)	415 + 10% volt, 3 phases, 50 + 5%Hzg
g)	Synchronous Speed	By bidder
h)	Motor rating	By bidder
i)	Motor efficiency	%
j)	Power factor	By bidder
k)	Speed of motors	By bidder
l)	Coupling type	By bidder

5.9.1 Motor accessories (If applicable)

i. Compressor grooved flywheel
ii. Motor grooved drive pulley
iii. Drive vee belts
iv. Flexible coupling for direct drive
v. Drive guard
vi. Adjustable motor slide rails for vee belt tensioning
vii. Starter

5.9.2 The motor name plate rating (exclusive of service factor) shall be minimum 115% of the greatest HP required under any of the specification operating conditions. All motors shall be tested in accordance with IS/IEC.

5.9.3 Pre-lubricated sealed bearings for all motors may be considered provided a full guarantee is given

5.10 CABLING (all suitable for hazardous area applications)

5.10.1 Control Cable inside the compressor package shall be of 1.5 Sq. mm and for outside compressor package shall be 2.5mm.

5.10.2 Cables shall be1100-volt grade, stranded copper conductor, XLPE insulated, PVC sheathed, round wire/flat armoured, FRLS cables.

5.10.3 Cables shall be terminated using double compression type metallic frame proof glands and copper lugs.

5.10.4 Spare cores to be kept in each control cable.

5.10.5 All JB's shall have flame proof metallic enclosure.

5.10.6 All the signal cables shall be screened armoured cables.

5.10.7 All the control and power cables shall be armoured cables.

5.10.8 All the communication cables shall be screened and shall be terminated to JB through threaded GI conduits only.

5.10.9 Communication/Control cables shall be routed through Cable Trays/conduits.

5.10.10 Following cables shall be supplied, laid and terminated by bidder:

a. Cables inside the compressor package

b. Termination of cables in compressor control panel including cable lugs and double compression glands etc. is in the bidder's scope.

5.10.11 Bidder shall furnish following electrical data along with bid:

SI. NO.	DESCRIPTION	TO BE FILLED BY BIDDER	REMARKS
1	**CABLES FOR PROCUREMENT AND ERECTION BY BIDDER**		The same shall be in the scope of bidder
	a) From PDB/emergency panel to air compressor control panel (three phase)		
	b) From UPS ACDB to compressor control panel (single phase)		
	c) From compressor to hooter and upto ESD push button in control room.		

	d) From compressor to ESD push button Near dispenser.		
	e) From compressor to ESD push button in CNG station area		
	f) Form LDB to Air Dryer		
2	FEEDER RATING IN PDB PANEL		
	a) FOR AUXILIARY LOAD (lights inside enclosure, exhaust fan etc.)	---- AMP	for providing feeder in PDB by client
	b) FOR AIR COMPRESSOR	---- AMP	
3	UPS LOAD	------ KW	
4	NON UPS LOAD	------ KW	

5.11 INSTRUMENTATION

5.11.1 All Instruments shall be suitable for an area classification of “Class 1, Group D, Division 1 as per NEC” OR “Zone 1, Group IIA /IIB as per IS/ IEC”.

5.11.2 All package mounted transmitters & temperature element shall be intrinsic safe "ib" as per IEC 79-11 and solenoid valves, switches and related junction boxes shall be flame proof “D" as per IEC 79-1. Other special equipment's/instruments, where intrinsic safety is not feasible or available, shall be flame proof as per IEC 79-1.

5.11.3 The compressor package instrumentation & control is to be configured for manual as well fully automatic control system including starting, shutdown as applicable for unattended operation. Control system shall be PLC based of a reputed make and proven type.

5.11.4 Electrical instrumentation shall be certified by a recognized authority such as BASEEFA, PTB, LCIE, CESI, INIEX, CMRS or any agency approved by Indian Government.

5.11.5 All the instrumentation shall be capable of operating for full range of operation.

5.11.6 Separate junction boxes shall be provided for each type of signal i.e., analog, digital, solenoids, RTD thermocouple and power supply.

5.11.7 RTD shall be 3 wire PT-100 and duplex type, thermocouple shall be K type and solenoid valve shall be 24 V DC operated.

5.11.8 Power cable, analog signal cable, digital signal cable shall be separately laid and properly tagged.

5.11.9 All pressure gauges and pressure transmitters shall be provided with isolation valves and have accuracy of + or - 1% of FSD and + or - 0.25% of FSD respectively.

5.11.10 Pressure transmitters shall be fixed range type with 2 wire 4 to 20 mA transmitter of piezoresisitive suitable for CNG applications except at suction and discharge which is 2 wire smart type 4 to 20 mA transmitter with integral display and IP 67 certified & ex-proof.

5.11.11 The temperature gauge shall be generally gel in steel filled type, weatherproof & with capillary

extension. Capillary tubing shall be min Carbon Steel with CS flexible armoring.

The gauge shall have accuracy of + or - 1% FSD. The range shall be 1.5 times of operating temperature.

5.11.12 Units of measurement shall be:

GAS FLOW : SCMHr & kg/hr

PRESSURE : kg/cm2 (g) TEMPERATURE : ^{0}C

5.11.13 One no. of dedicated Serial Communication Port shall be provided for programming the PLC through Laptop with required adapter, cable, software, etc. Necessary adopter if required shall be under scope of vendor. Also, Vendor shall include one set of all licensed relevant Software (Windows based system configuration software and application program) for accessing the PLC, HMI and mass flow meter through owner supplied Laptop PC. All the parameters available on the PLC shall be made available to SCADA system through RS 485 port on Modbus communication protocol. All the parameters available on the PLC can be hook up to future SCADA system through RS 485 port on Modbus communication protocol. The detail requirement of SCADA will be communicated to successful vendor during detailed engineering. For selection of equipment, compatibility of SCADA system, vendor shall consider the Modbus RTU protocol, FCC-68 RJ 45 connection type RS 232 communication standard, Baud rate up to 19.2 K with configurable software.

5.11.14 Following points to be noted regarding Mass Flow meter- Coriolis type required at Suction, Discharge and Gas inlet to Engine (only for Gas engine driven compressor).

a. Each Mass Flow meter shall include a sensor with integral transmitter i.e. meter electronics certified intrinsically safe/explosion proof by statutory authority suitable for the required hazardous area as per IS-2148 /IEC-79. Also the offered sensor and the transmitter shall be weather proof to IP 65 as per IS- 2147/IEC-529. Statutory authority for local installation is CCOE/ PESO.

b. For online Calibration of MFM; Vendor to provide suitable arrangement to connect Master Mass flow meter (Prover) with Compressor Suction & Compressor Discharge flow meter for calibration purpose. Indicate and provide the details in P&ID.

c. Offered mass flow-meter shall be necessary for Custody Transfer application at compressor suction and discharge and accuracy should be in the range of 0.5% of span. Type approval Certificate from W& M India is required.

d. Vendor has to calibrate all instruments including mass flow meter & perform Pressure vessel testing within 1 month of compressor commissioning. Vessel testing date and due date for retesting to be painted on all vessels.

e. Flying lead type electrical termination is not acceptable. All electrical connections shall be ½" NPTF. Cable glands shall be provided for electrical power, signal and control connections. Cable glands shall be double compression type and certified weatherproof and explosion proof for the required area classification as per IS-2147 and IS-2148.

f. Offered Mass flow meter shall be completely free from corrosion of measuring tube due to alternating stresses continuously occurring in the tube. Also measuring tube shall be completely free from erosion, which may result due to fluid velocity.

g. The design of meter electronics shall be in compliance with the electromagnetic compatibility requirements as per IEC-801.

h. Meter Electronics shall include all the associated pre-amplifiers converters, line riser etc and shall have enough diagnostic facility to correct live zero, variation, meter factor etc with help of Laptop.

i. Mass flow meter should be interface with PLC on serial communication.
Mass flow meter shall be powered by 24 V DC only.

j. Installation details as per AGA-11 recommendations have to be followed.
For horizontal /vertical installation, supports etc OEM recommendations shall be followed and to be provided.

k. Vendor shall calibrate each Mass Flow meter from the statutory authority of country of origin (OEM certificate only) or any recognized test house (for India from FCRI) with the fluid for which it is to be used. In case it is not possible to calibrate the Mass Flow meter with actual fluid. Vendor must indicate.

i. Fluid used for calibration

ii. Correction factor/Adjustment required for actual process fluid. In any case, inaccuracy when extended to actual process shall not exceed the specified limits (as per manufacturer's standard).

The calibration certificate should be valid for at the time of supply. The validity of calibration will be considered one year from the date of calibration. If the same is expired then the recalibration has to be done from FCRI as per the latest NABL/IS standards with the fluid.

l. Vendor shall submit the following test certificates and test reports for purchaser's review:-

i. Material test certificate with detailed chemical analysis from foundry (MIL Certificate).
ii. Certificate of radiography / x-ray for any welded joint.
iii. Hydrostatic test report with pressure of 1.5 times the design pressure.
iv. Calibration report including calibration factors for each Mass flow meter certificate from statutory body for offered sensor and transmitter for required area classification.
v. W&M India certificates.

5.11.15 CERTIFICATION:

The requirement of statutory approvals for usage of equipment / instruments / system in electrically hazardous areas shall be as follows:

a. The vendor shall be responsible for obtaining all statutory approvals, as applicable for all instruments and control systems.

b. Equipments / instruments / systems located in electrically hazardous areas shall be certified for use by statutory authorities for their use in the area of their installation. In general, the following verification shall be provided by the vendor.

i. Bidder shall provide certificates (from BASEEFA FM, UL, PTB, LCIE etc.) from country of origin for all intrinsically safe/flameproof protected by other methods equipment/instrument/systems, which are manufactured outside India. If required, bidder shall provide necessary certification / approvals / authentication, for all such intrinsically safe /flame proof equipment / instrument / systems, by the Indian authority- Chief Controller of Explosive (CCOE) / PESO, Nagpur, India.

ii. For all flame proof equipment manufactured within India, the testing shall be carried out by any of the approved testing houses- Central Mining Research Institute (CMRI) / ERTL etc. The item shall in addition bear the valid certification from CCOE / PESO and also the manufacturer shall hold a valid Bureau of Indian Standards (BIS) licence.

iii. For all intrinsically safe equipment manufactured within India the testing shall be carried out by any of the approved testing houses - Central Mining Research Institute (CMRI) / ERTL etc. The item shall in addition bear the valid certification from CCOE

5.12 Earthing of equipment:

5.12.1 Bidders shall make provisions for earthing of the complete package as required as per IS (Earth pits are not in Bidder's scope). All electrics shall comply with latest IS/IEC. Epoxy based paints shall be applied on all electrical equipments. Bidder's scope shall include obtaining statutory approvals for the complete package, wherever necessary.

5.12.2 Metallic part of all equipment not intended to be alive shall be connected to earth as per provisions of IS: 3043/IEC recommendation. Grounding of all electronics shall be separately connected to earth using insulated copper wire. Grounding of electronic equipment shall not be connected to earthing for electrics or equi- potential bonding

6.0 INSPECTION AND TESTING

6.1 General

a. Inspection and Test Requirements have been spelled out in respective Equipment Data Sheets and this Technical Specification.

b. Bidder shall confirm compliance to all inspection and testing requirements stipulated therein and include the inspection charges in the lump sum cost.

c. Owner/consultant shall witness tests as per data sheet and this specification. The Bidder shall notify the timing of such inspection and testing at least 15 days in advance to PURCHASER / CONSULTANT. PURCHASER / CONSULTANT shall depute their representative for witnessing the tests.

c. Bidder shall submit detailed Test Procedure for Approval of the Purchaser two months in advance of the actual date of conducting each test.

e. Inspection testing for foreign bidder: Cost of third party inspection including fees payable and arranging the same shall be borne by bidder. Approved

3rd party inspection agencies are CEIL, BVQI, DNV, and Lloyd's reg/TUV/AB-Vincotee/SGS/American bureau services/ Velosi certification services/International certification services limited/BV/ Dr. Amin Controllers Pvt. Ltd..

f. Inspection testing for Indian bidder: Owner/Consultant shall carry out Inspection and testing as per QAP, inspection charges shall be considered @1.0% of the ex-works price excluding duty and taxes of the equipment for price evaluation purpose only. Domestic bidder shall also arrange 3rd party for inspection as indicated in QAP and expenses on third party inspection including fees payable and arranging the same shall be borne by bidder.

6.2 Mechanical running test (MRT)

6.2.1 The MRT for the each compressor shall be carried out by tenderer with job or shop driver including complete job driving system i.e., job driven V-belt, job pulleys etc., for 4 hours continuously at shop of compressor manufacturer. The compressor need not be pressure loaded for MRT test. During this test following shall be recorded at agreed intervals.

a. Vibration levels measured on cylinders and frame.
b. Bearing temperature.
c. Oil cooler inlet and outlet temp.
d. Sound level

Subsequent to satisfactory run, the compressor shall be examined as per standard procedure & following shall be examined as minimum:

Internal Inspection certificate for strip test after no-load run of compressor is to be submitted for review of BGL.

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Strip test is limited to open Crank Case cover, X-Hd guide & Dist. pc. Cover and opening of bore & other parts, piston, one valve per cylinder. Visual examination of position rod.

If any of part found damaged, all similar components shall be stripped for inspection. The MRT test shall be repeated after replacement of such parts.

All the interlocking and performance of the instrumentation system will be verified during the MRT.

6.3 Mechanical String Test

Mechanical String Test for 4 hrs shall be performed at packager's shop before dispatch in presence of Purchaser/Consultant. This test can be clubbed up with the Mechanical Run Test of compressor as specified above, provided the job driver, lube Oil system is used for the test. Air/N2 can be used for string test purpose if natural gas is not available in the shop. All parameters including discharge pressure shall be demonstrated. All the interlocking and performance of the instrumentation system will be verified during the MST. String test at unload condition is not acceptable.

6.3.1 Compressor capacity during string test

The string test for this compressor shall be performed at suction pressure 16 kg/cm2 (g) for 4 hrs continuously and the capacity shall be recorded. In case the capacity is found to be not meeting the requirement, the compressor shall not be accepted.

6.4 Package Performance Test (PT)

Bidder shall assemble the complete package including auxiliary systems, instrumentation, safety devices within the enclosure at his shop and dispatch. Duration of PG test shall be min. 4 hours continuously. Complete package shall be performance tested as a module along with gas engine & compressor as per

Proforma (to be decided during engineering). Bidder shall demonstrate all controls, shutdown, trips & alarms, functioning of Instrumentation system, PLC, Motor / Gas engine etc. **Pressure and temperature of gas shall be considered at purchaser's boundary limit (or before filter unit of package if provided) and as indicated in the Instrumentation schedule; if provision not available then supplier shall install necessary pressure and temp measuring devices**. Discharge PT & TT of compressor will use for discharge pressure and temperature measurements. All instrument duly calibrated, tools & tackles, any modification required for conducting PT shall be in the scope of supplier.

6.4.1 The PT shall be conducted only after 30 days' running of the machine after successful commissioning or after 30 days from the date of commercial operation, but not later than 90 days from the date of commercial operation of the machine. The delay in conducting PT beyond 90 days shall be liable for PRS unless such delays are solely attributable to the owner (i.e, due to inadequate load, i.e., non-availability of CNG vehicles for conducting PT). **Refer Payment terms for payment towards PGT If PGT cannot be conducted due to reasons directly attributable owner. If the CNG load is not available for running the compressor for continuous 4 hrs. even after 6 months from the date of commissioning, BGL shall allow to conduct PGT for a lesser period based on availability of load for a duration of min.30 mins.**

6.4.2 The test shall be the basis of assigning penalties on the Bidder, acceptance / rejection of the package thereon. Bidder shall submit the detail test procedure for the same, which shall be approved by PURCHASER/CONSULTANT. The test for the package shall be witnessed by PURCHASERL/CONSULTANT.

6.4.3 Bidder to note that prime mover speed correction shall not be allowed below guaranteed speed. **Temperature and pressure will be considered at purchaser's boundary limit.**

7.0 PRICE LOADING AND COMPENSATION FOR UNDER PERFORMANCE

i) FOR 1200 SCMH COMPRESSORS:

a) This section describes the guaranteed parameter, which the CNG compressor package must fulfill and the penalty for shortfall in guaranteed parameters and rejection of compressor package by the Purchaser.

b) The guaranteed parameter shall be adjusted to account for variation in gas composition and prevailing ambient condition during testing.

c) necessary calculations hall have to be furnished by Bidder, which shall be final and no deviation shall be permitted afterwards.

d) In case of any inconsistency in manufacture and/or operation of supplied compressor package, Bidder shall at his own risk and cost, eliminate the defects to the satisfaction of Owner.

Bidder shall furnish guaranteed values as per Cl. No. 14 of this specification.

7.1 Compressor Capacity

Bidder shall guarantee 1200 SCMH capacity of compressor with design case gas composition, at suction pressure of 16 kg/cm^2(g) and at suction temperature of 30^{o}C, discharge pressure of 255 kg/cm^2(g) with no negative tolerance for errors in instruments and measurements.

Since the compressor suction pressure varies from 16 kg/cm^{2}g to 19 kg/cm^{2}g at present, the compressor shall be suitable to deliver flow of 1200 SCMH corresponding to 16 kg/cm^{2}g to 19 kg/cm^{2}g at present.

For calculation purpose 1kg of CNG =1.33 SCM

The same shall be used to establish the capacity at test bed during package performance test.

In both the above cases the driver shall be selected corresponding to max capacity. Mechanically the compressor shall be suitable to operate from min to max suction pressure without throttle and suction valve full open condition. Bidder to note that the suction pressure and temperature shall be measured at vendor's boundary limit and not at compressor cylinder.

Bidder shall guarantee compressor capacity in SCMH as per MR item for design case gas composition, suction pressure and suction temperature as specified against guaranteed condition with discharge pressure of 255 kg/cm2(g) with no negative tolerance for errors in instruments and measurements. Mechanically the compressor shall be suitable to operate from min to max suction pressure without throttle and suction valve full open condition.

7.2 Loading & Compensation Criteria

This section describes the guaranteed parameter, which the CNG compressor package must fulfil, the penalty for shortfall in guaranteed parameters and rejection of compressor package by the Purchaser.

The guaranteed parameter shall be adjusted to account for variation in gas composition and prevailing ambient condition during testing.

Necessary calculations correction curves shall have to be furnished by Bidder along with bid, which shall be final & no deviation shall be permitted afterwards.

In case of any inconsistency in manufacture and/or operation of supplied compressor package, Bidder shall at his own risk and cost, eliminate the defects to the satisfaction of Owner.

Bidder shall furnish guaranteed value as per Annexure enclosed with this specification

A. Package Gas Loss:

The bidder shall design the compressor package so that no venting and leakage of gas takes place. Bidder shall indicate actual vent & leakage losses through the compressor package. If package loss is quoted more than 1% of suction capacity gas consumption than bid shall be rejected. This quoted figure will be used for evaluation and total quoted price for all compressors towards supply, special tools and tackles, transportation, erection & commissioning, operations and comprehensive maintenance will be calculated as per following formulas:
F = G x H x I x N x W
where,

F = Amount in Rs.
G = Vent/Leakage rate quoted in percentage
H = Cost of Natural Gas per Kg @ Rs. 52/- per kg
I = Avg. no. of running hours per year i.e. @ 3650 hours
N = Number of machines
W = 900 kg for 1200 SCMH

B. Engine Fuel Consumption:

The compressor package shall be designed in such a way that Gas Consumption of engine (Kg/Hr) should be minimum for production of CNG.

Bidder shall indicate actual gas consumption for their compressor package. This quoted figure will be used for evaluation and total quoted price for all compressors towards supply, special tools & tackles, erection and commissioning will be calculated as per following formulas:

F = G x H x I x N
Where, F = amount in Rs.
G = Bidder's Gas consumption rate quoted in Kg/hr for every 1200SCMH (900 Kg) of CNG produced
H = Cost of Natural Gas per Kg @ Rs. 52/- per kg
I = Avg. no. of running hours per year i.e. @ 3650 hours
N = Number of machines

Notes:

1. Fuel Consumption quoted by the bidder under guaranteed parameters shall lie within the range of 34 to 36 Kg/hr for 1200 SCMH. No benefit will be given below 34 Kg/hr for 1200 SCMH. In case the fuel consumption quoted by the bidder exceeds the upper limit i.e. 36 Kg/hr for 1200 SCMH, the bid will be rejected.

2) The amount (F) as per the above calculations for 5 years shall be considered on NPV basis with discount factor @10% p.a.

ii) FOR 600 SCMH COMPRESSORS:

a) This section describes the guaranteed parameter, which the CNG compressor package must fulfill and the penalty for shortfall in guaranteed parameters and rejection of compressor package by the Purchaser.

b) The guaranteed parameter shall be adjusted to account for variation in gas composition and prevailing ambient condition during testing.

c) necessary calculations hall have to be furnished by Bidder, which shall be final and no deviation shall be permitted afterwards.

d) In case of any inconsistency in manufacture and/or operation of supplied compressor package, Bidder shall at his own risk and cost, eliminate the defects to the satisfaction of Owner.

Bidder shall furnish guaranteed values as per cl. 14 of this specification.

7.3 Compressor Capacity

Bidder shall guarantee 600 SCMH capacity of compressor with design case gas composition, at suction pressure of 16 kg/cm^2(g) and at suction temperature of 30^{o}C, discharge pressure of 255 kg/cm^2(g) with no negative tolerance for errors in instruments and measurements.

Since the compressor suction pressure varies from 16 kg/cm^{2}g to 19 kg/cm^{2}g at present, the compressor shall be suitable to deliver flow of 600 SCMH corresponding to 16 kg/cm^{2}g to 19 kg/cm^{2}g at present.

For calculation purpose 1kg of CNG =1.33 SCM

The same shall be used to establish the capacity at test bed during package performance test.

In both the above cases the driver shall be selected corresponding to max capacity. Mechanically the compressor shall be suitable to operate from min to max suction pressure without throttle and suction valve full open condition. Bidder to note that the suction pressure and temperature shall be measured at vendor's boundary limit and not at compressor cylinder.

Bidder shall guarantee compressor capacity in SCMH as per MR item for design case gas composition, suction pressure and suction temperature as specified against guaranteed condition with discharge pressure of 255 kg/cm2(g) with no negative tolerance for errors in instruments and measurements. Mechanically the compressor shall be suitable to operate from min to max suction pressure without throttle and suction valve full open condition.

7.4 Loading & Compensation Criteria

This section describes the guaranteed parameter, which the CNG compressor package must fulfil, the penalty for shortfall in guaranteed parameters and rejection of compressor package by the Purchaser.

The guaranteed parameter shall be adjusted to account for variation in gas composition and prevailing ambient condition during testing.

Necessary calculations correction curves shall have to be furnished by Bidder along with bid, which shall be final & no deviation shall be permitted afterwards.

In case of any inconsistency in manufacture and/or operation of supplied compressor package, Bidder shall at his own risk and cost, eliminate the defects to the satisfaction of Owner.

Bidder shall furnish guaranteed value as per Annexure enclosed with this specification

A. Package Gas Loss:

The bidder shall design the compressor package so that no venting and leakage of gas takes place. Bidder shall indicate actual vent & leakage losses through the compressor package. If package loss is quoted more than 1% of suction capacity gas consumption than bid shall be rejected. This quoted figure will be used for evaluation and total quoted price for all compressors towards supply, special tools and tackles, transportation, erection & commissioning, operations and comprehensive maintenance will be calculated as per following formulas:

F = G x H x I x N x W
where,
F = amount in Rs.
G = Vent/Leakage rate quoted in percentage
H = Cost of Natural Gas per Kg @ Rs. 52/- per kg
I = Avg. no. of running hours per year i.e. @ 3650 hours
N = Number of machines
W = 450 kg for 600 SCMH

B. Engine Fuel Consumption:

The compressor package shall be designed in such a way that Gas Consumption of engine (Kg/Hr) should be minimum for production of CNG.

Bidder shall indicate actual gas consumption for their compressor package. This quoted figure will be used for evaluation and total quoted price for all compressors towards supply, special tools & tackles, erection and commissioning will be calculated as per following formulas:

F = G x H x I x N
Where, F = amount in Rs.
G = Bidder's Gas consumption rate quoted in Kg/hr for every 600SCMH (450 Kg) of CNG produced
H = Cost of Natural Gas per Kg @ Rs. 52/- per kg
I = Avg. no. of running hours per year i.e. @ 3650 hours
N = Number of machines

Notes:

1. Fuel Consumption quoted by the bidder under guaranteed parameters shall lie within the range of 19 to 21 Kg/hr for 600 SCMH. No benefit will be given below 19 Kg/hr for 600 SCMH. In case the fuel consumption quoted by the bidder exceeds the upper limit i.e. 21 Kg/hr for 600 SCMH, the bid will be rejected.

2) The amount (F) as per the above calculations for 5 years shall be considered on NPV basis with discount factor @10% p.a.

7.5 PENALTIES

7.5.1 Penalty towards Excess Package Gas Loss:

During the O&M period, cost towards excess gas loss beyond the quoted figure shall be deducted from O&M bills.
Following calculations shall be used for deduction towards excess gas loss:
F = 1.2 x [(G-(Q*D)) *H]
Where, F = Penalty in Rupees to be deducted from O&M bill
G = Monthly Vent/Leakage loss observed during O&M period in Kg
Q = Vent / Leakage loss quoted in percentage
H =Cost of Natural Gas per Kg (Prevailing rate of natural gas on the 1st day of the particular month shall be considered)
D = Production of CNG during the month in Kg (discharge meter)

Considering "G" above shall be taken as (Suction Reading – Discharge Reading – Engine Fuel

Consumption Reading of Mass Flow meters)OR Reading from Vent Mass Flow Meter, whichever is higher.

7.5.2 Penalty towards Excess Engine Fuel Consumption:

During the O&M period, cost towards excess fuel consumption beyond quoted figure shall be deducted from O&M bills.
Following calculations shall be used for deduction towards excess fuel consumption:
F = 1.2 x [(G-Q*D) x H]
Where, F = Monthly Penalty in Rs. To be deducted from O&M bills
G = Monthly Actual Gas consumption in Kg
Q = Guaranteed consumption rate quoted by supplier x CNG produced during the month
H = Cost of Natural Gas per Kg (Prevailing rate of natural gas on the 1st day of the particular month shall be considered)
D = Production of CNG during the month in Kg (discharge mass flow meter)

7.5.3 Penalty towards Package Efficiency Loss

Rs. 2/ Kg will be recovered for delivering each kg lesser than the rated capacity & following calculations shall be used:
F = 2 x {(1200 x H x RD x AD) – M} for 1200 SCMH Compressors
And
F = 2 x {(600 x H x RD x AD) – M} for 600 SCMH Compressors
Where,
F = Penalty Amount in Rupees
H = Package actual running hours in a month
RD = Average RD for the month using GC Data
AD = Air Density = 1.22541
M = Discharge mass flow during the month in Kgs

Notes:
1) Package Inlet Pressure at PLC shall be used as benchmark for imposition of penalties.
2) Pressure regulator shall not be used to reduce the pressure at the compressor block inlet below 16 Kg/Cm2.
3) In case pipeline pressure at the station itself is less than 16 Kg/Cm2, then the penalty shall be imposed if the package delivery falls below discharge values corresponding to the Compressor's pressure curve, supplied at the time of bid submission only.

7.5.4 Penalty for Non-Performance during Period of Operation & Maintenance

Details of Penalty for non-performance of equipment

a. On normal day (i.e. the day other than the schedule maintenance day):

i. The Contractor/Bidder has to ensure that the equipment is available for operation for minimum 20 hours per day and on an average the equipment availability has to be 95% in a month.

ii. If the equipment is down for more than 8 hours on any day or availability is less than 95% in a month. Penalty would be applicable as follows:

- Upto 8 hours: Nil

- 8 hours to 16 hours: Rs. 10,000/- per day
- 16 hours to 24 hours: Rs. 15,000/- per day
- More than 24 to 72 hours – 25,000/- per day

iii. In case there is a continuous breakdown beyond 72 hours up to 15 days, 50% of monthly maintenance charges excluding operational Charges will be deducted.

iv. In case there is a continuous breakdown beyond 15 days and upto30 Days, 75% of monthly maintenance charges excluding operational Charges will be deducted.

v. In case there is a continuous breakdown beyond 30 days of a calendar month, 100% of monthly maintenance charges excluding operational Charges will be deducted.

vi. In case of daily availability is 20 hrs. but monthly average availability is below 95%, then penalty @ of Rs. 10,000 per % or part thereof shall be applicable.

b. On schedule maintenance day (excluding periodic major overhaul of compressor/engine):

i. If the equipment is down for beyond the time indicated for the agreed schedule maintenance, the Contractor/Bidder will be penalized as per follows:

- Up to 8 hours: Nil
- 8 hours to 16 hours: Rs. 10,000/- per day
- 16 hours to 24 hours: Rs. 15,000/- per day
- More than 24 to 72 hours: Rs. 25,000/- per day

ii. In case there is a continuous breakdown beyond 72 hours up to 15 days, 50% of monthly maintenance charges excluding operational Charges will be deducted.

iii. In case there is a continuous breakdown beyond 15 days and up to 30 Days, 75% of monthly maintenance charges excluding operational Charges will be deducted.

iv. In case there is a continuous breakdown beyond 30 days of a calendar month, 100% of monthly maintenance charges excluding operational Charges will be deducted.

8.0 PAINTING AND PROTECTION

8.1 SURFACE PREPARATION

a. Rust, rust scale and foreign matter shall be removed fully to ensure that a clean and dry surface is obtained. The minimum acceptable standard for blast cleaning shall be Sa 2-1/2 or equivalent as per Swedish Standard SIS-055900- 1967 or equivalent.

b. Blast cleaning shall not be performed where dust can contaminate surfaces undergoing such cleaning or during humid weather conditions having humidity exceeding 85%.

c. The first coat of primer must be applied by brush on dry surface. This should be done immediately after cleaning.

d. Surface shall be inspected by Purchaser/ third party before application of primer.

8.2 PAINTING (PRIMER & FINISH COAT)

Following primer and finish coats to be applied on the canopy and all structural parts as a minimum:-

a)	Primer	Two component epoxy zinc phosphate primer with minimum volume solids of 59%, an initial cure of 75 minutes at 25 deg. C and a weight of around 2.52 kg/litre.
	No. of Coats:	1
	DFT	75 (micron) µ each
b)	Primer	Two component intermediate coat with epoxy high build MIO (micaceous iron oxide) of minimum volume solids of 80%, an initial cure of 60 minutes at 25 deg. C and a weight of around 2.1 kg/ litre.
	No. of Coats:	1
	DFT	100 micron
c)	Finish Coat:	Acrylic Polyurethane paint
	No. of Coats:	2
	DFT	50 (micron) each coat
	Total DFT	100 µ

Total DFT after application of primer and paint shall be 275 µ (micron) minimum.

8.3 The vendor to ensure that exterior steel surface of equipment and piping painted shall have a fade free life without oxidation of paint surface for at least 5 years in an environment of bright sunlight with an intense UV content.

8.4 The headers of air-cooled exchanger shall be zinc sprayed/painted.

8.5 Packing shall be sufficiently robust to withstand rough handling during ocean shipment & in-land journey. Sling points shall be clearly indicated on crates.

9.0 ERECTION, TESTING AND COMMISSIONING AT SITE

9.1 Bidder shall be responsible for erection, commissioning, performance test, field noise level test and field trial run of all compressor packages at site.

9.2 Bidder shall be liable to pay all local taxes, levies applicable and comply with rules, laws prevailing in concerned state.

10.0 FIELD TRIAL RUN (COMMISSIONING AND COMMERCIAL OPERATION)

Bidder shall conduct a field trial run of each compressor package for minimum 72 hours cumulative or 6 hours continuous duration near the guaranteed points in which satisfactory operation of complete package together with all accessories/auxiliaries controls shall be established for specified operating conditions prior to the start of operation and maintenance period as defined in the contract. During the field trial run, the bidder will be allowed a

maximum of three attempts to complete the above-specified test. The Equipment shall be considered commissioned after the successful completion of Field Trial Run. Further Commencement of commercial operation will be intimated by client.
OR Due to non-availability of the commercial load at CNG station, package will be treated as commissioned after filling of CNG cascades to min.100kg/cm2(g) installed at station.

11.0 SPARE PARTS, SPECIAL TOOLS AND TACKLES

11.1 All spare parts as required, special tools & tackles with toolbox for erection and commissioning and operation and maintenance of compressor package shall be supplied by the packager and shall form his scope of supply.

11.2 A brand new separate set of min 10 nos special tools and tackles (such as tool for extraction of fly wheel, key to hold crank shaft for loosing & tightening mech seal/bush, special key to install and uninstall bush for mech seal, piston nut wrench, valve installation tool, rod nut wrench, valve adjusting wrench, engine timing light, engine barring tool, spark plug removal tool, etc) as required for Normal maintenance beyond the contractual operation & maintenance period shall be supplied by the packager, which shall form the property of PURCHASER. Special tools & tackles used by bidder in during O&M period shall not be considered as new. Supply shall be before one month of completion of O&M period

12.0 DATA AND DRAWING

a. Drawings and Data shall be furnished in conformity with the Bidder Data Requirements Forms attached with Enquiry Specifications.

b. Bidder shall furnish all the information at the time of bidding as specified in the relevant Bidder Data Requirement (VDR) forms.

c. The data requirement after placement of Fax of intent/Acceptance is indicated in the Bidder data requirement forms for the respective equipment, including the number of weeks within which this data is to be provided. Bidder shall confirm that all data as required shall be furnished by him and shall indicate the Bidder's promised data in the columns provided.

d. After the placement of FOI/FOA, a conference (kick off meeting) will be held at such date and at such place, as may be mutually agreed upon between the Bidder and the Purchaser. The intent of this conference shall be to discuss / clarify various requirements and finalize the modus operandi for execution of the contract within the scheduled delivery period.

e. Bidder shall furnish the Drawings/Documents for Purchaser's Review / approval as per the Bidder Data Requirement (as specified in the Specifications/ Bidder data requirement forms). The review comments for major and critical drawings (such as system P&ID's, operation philosophy , General Arrangement Drawings, Foundation Drawings, Performance characteristics, etc.) shall be discussed across the table at such date and place as may be mutually agreed between the Purchaser and the Bidder.

12.1 DRAWINGS AND DATA REQUIRED FROM BIDDER

(All drawings & Documents shall be in English Language only and shall be submitted in three sets)

DESCRIPTION		Required with bid	Certified Information Required after Purchaser order/FOA	
(1)		(2)	(3)	(4)
A	**General**			
A.1	Schedule for furnishing the vendor data			Yes
A.2	A specific statement that CNG compressor package is in strict accordance with data sheet, technical specification & applicable standards, In case of any deviation, specific list with details & reasons for each deviation.	Yes		
A.3	General arrangement (GA) of following equipment indicating battery limit for electric, piping connection & Flange details of piping connection at battery limit. i. Compressor package ii. Air compressor, dryer& receiver iii. CO_2 flooding system. iv. Duplex filter v. PRV+SSV		Yes	
A.4	A statement on oil consumption and minimum allowable oil temp.			Yes
A.5	Void			
A.6	Duly filled in experience record program	Yes		
A.7	Foundation plan drawings along with load details of compressor package, Air compressor, dryer, receiver, Duplex filter, CO2 flooding system &PRV+SSV			Yes
A.8	List of sub-vendors for all bought out items including electrical & instrumentation items.		Yes	
A.9	Leaflet, catalogues for all items.		Yes	
A.10	O & M manual			Yes
B	**Compressor**			
B.1	Data Sheet duly filled in.			Yes
B.2	Void			
B.3	Void			
B.4	Void			
B.5	Cooler data / drg with thermal & mech. design calculation		Yes	
B.6	Design calculation, GA drgs for pulsation dampner/volume bottles.		Yes	
B.7	Gas , hydraulic oil, lube oil piping & instrument diagram		Yes	
B.8	Void			
B.9	Torque speed characteristic. Starting torque of engine and compressor to be superimposed over each other.		Yes	

B.10	Void			
B.11	Void			
B.12	Void			
B.13	Drg. For testing arrangement & test procedure to be adopted.		Yes	
B.14	Quality Assurance Plan (QAP) and Quality Procedure		Yes	
B.15	Void			
B.16	Void			
B.17	Test records of following		Yes	
	a) Mechanical running		Yes	
	b) Performance test		Yes	
	c) Noise level test		Yes	
B.18	List of special tools & tackles for installation & maintenance		Yes	
B.19	Filled in air cooler data sheet		Yes	
C	**Electric equipment and motors**		Yes	
C.1	Performance curves of motor		Yes	
C.2	Void			
C.3	Filled in data sheet of motor and Gas engine and UV detection system		Yes	
C.4	Control schematics of motors	Yes	Yes	
C.5	Performance curves for auxiliaries like fan, pump along with motor	Yes	Yes	
C.6	Typical component cross sectional drawing and literature to fully describe the details of offering.	Yes	Yes	
C.7	Test procedure of motor		Yes	
C.8	Mill test report of motors		Yes	
C.9	Manufacturer's test report of motors		Yes	
C.10	Stage inspection and test report		Yes	
C.11	Final acceptance testing and performance tested records.		Yes	
C.12	Schematic diagram with start-up & shut down procedure & logic		Yes	
C.13	Inter connection & wiring diagram		Yes	
D	**INSTRUMENTATION AND ELECTRICALS**			
D.1	Void			
D.2	Instruments and electric motor data sheets		Yes	
D.3	Control philosophy comprising of start-up and shut down write up along with interlocks, Alarm & shut down list.		Yes	
D.4	Void			
D.5	Void			
D.6	Control panel layout		Yes	
D.7	Termination diagram, panel writing detail		Yes	
D.8	Loop schematic		Yes	
D.9	Inter connecting diagram		Yes	
D.10	Cable schematic		Yes	

D.11	Void			
D.12	Void			
D.13	Test / Inspection certificate		Yes	
D.14	List of relief valves with settings		Yes	
D.15	P & ID of priority panel.		Yes	
D-16	Electrical Load summary	Yes		
D-17	Power required from UPS Supply (230 V AC Single Phase)	Yes		
D-18	Power required from Non UPS Supply (415V TPN)	Yes		

Note:

a. Drawings/ document as indicated above and which are required to be submitted after placement of order for approval shall be submitted in following sets:

i. 1 CD- of all documents/drawing in editable form (As built drawings only);
ii. 2 sets of prints;
iii. One no licensed CD of software for compressor PLC

On successful award of work, the drawings/documents shall be submitted for approval as per the scope of work.

13.0 OPERATION & MAINTENANCE SERVICES

The date of successful performance test (PT) at site (which shall be conducted within 90 days from the date of successful commissioning of the machine) will be considered as date of start of the annual maintenance contract. However, bidder shall be paid only
50% of O&M charge for operation and maintenance of the compressor from the date of commercial operation upto the date of performance test as part payment against O&M till the capacity and other guaranteed parameters of the package is established through PT. The balance 50% of O&M charge (from the date of commercial operation upto the date of PG test) shall be released to the bidder subsequent to successful PT (ie, after establishing all the guaranteed parameters as per tender) In case the PT is not successful, the balance 50% shall be forfeited in addition to provision of cl. 7.5.4 of this Section. The bidder must follow the 'OPERATION &MAINTENANCE REQUIREMENT' as stated below but not limited to and ensure to provide trouble free services to the satisfaction of the owner

13.1 Accommodation/Transportation/Medical

The bidder shall make his own arrangement for the accommodation of his personnel at respective locations and subsequent transportation arrangement for them from their place of residence to work place or any other place as required and company shall have no obligation in this respect. The company shall not be responsible for providing any medical assistance to the bidder personnel.

13.2 Discipline:

The bidder shall be responsible for the discipline and good behavior of all his personnel deployed in the services contracted out and should any complaint be received against any of his employee,

he shall arrange to replace such persons within 24 hours of notice issued by the Engineer-in-Charge. The decision of the Engineer – in-Charge in this matter shall be final and binding on the Bidder.

13.3 Gate pass/identity card

The contract shall arrange to supply / renew identity card to his workforce at his own cost, if so required by the Purchaser for security or for any other reasons. Those

Bidder's personnel shall be required to carry their respective identity cards while on duty and produce on demand.

13.4 Right to get services carried out through other agencies

Nothing contained herein shall restrict Purchaser from accepting similar service from other agencies, at its discretion and at the risk and cost of the Bidder, if the bidder fails to provide the said services any time.

13.5 Sub-letting of contract

Operation & comprehensive Maintenance Services may be sublet after the due permission of purchaser. The bidder may sublet the Operation & Comprehensive Maintenance services to an agency having experience of CNG compressors Operation & Comprehensive Maintenance for min two years. However, complete responsibility including composite bank guarantee shall be furnished by the bidder/supplier. Bank guarantee for O&M shall start from the date of commercial operation by the purchaser which will be as per relevant SCC clause.

13.6 Compliance of laws

The bidder deploying 20(twenty) or more workmen as contract labour shall have to obtain license from appropriate licensing authority, if required. The bidder (which shall include the Contracting firm / company) shall be solely liable to obtain and to abide by all necessary licenses from the concerned authorities as provided under the various labour laws legislation's including labour license from the competent authority under the Contract Labour ("Regulation & Abolition") Act or similar act applicable to land of law. The Contractor at his own cost shall comply with all statutory regulations required for this Work. All statutory liabilities of payment of ESI/PF or other statutory payments as may be applicable will be borne by the Contractor. The installations where job is to be carried out are live and have hydrocarbon environment. Bidder shall comply with all safety and security rules and regulations and other rules laid down by PURCHASER for its operation. It shall be the duty/responsibility of the bidder to ensure the compliance of fire, safety, security and other operational rules and regulations by his personnel. Disregard to these rules by the Bidder's personnel will lead to the termination of the contract in all respects and shall face penal/legal consequences.

The bidder shall arrange for insurance of all this workers engaged on the job as per the relevant Acts, rules and regulations, etc. In case by virtue of provisions of worker's

compensation Act, or any other law in force. PURCHASER has to pay compensation for a workman employed by the bidder due to any cause whatsoever the amount so paid shall be recovered from the dues payable to the bidder and /or security deposit.

Contract Labour Act & Minimum Wages Act: Contractor shall ensure that all formalities like obtaining all permissions and licenses not limited to but including the contract labour license etc. as required by law are fulfilled by him at appropriate stipulated times. Contractor shall be

responsible for all legal liabilities concerning the labour employed by him at site. The Contractor shall comply with all the statues and legislation including but not limited to Payment of wages, Minimum wages etc. relating to labourers /workers. The Contractor shall indemnify and keep purchaser indemnified against all or any of the liabilities that may arise out of its not complying with any of the legislations.

Contractor shall not engage /deploy any child and the persons to be deployed should be physically and mentally fit. The Contractor shall ensure that he does not violate any of the laws of land and shall ensure that he respect and follow the contents of purchaser Values Charter which will be given to successful bidder.

The Bidder has to ensure payment of wages shall be as per minimum wage of the appropriate govt applicable under the minimum wage act.

The officer in charge shall have power to

i. Issue the bidder from time to time during the running of the contract such further instructions as shall be necessary for the purpose of proper and adequate execution of the contract and the bidder shall carry out and bound by the same.

ii. During the currency of this contract, PURCHASER can increase and/or decrease the number of the services / technicians to meet contractual requirements.

iii. Order the bidder to remove or replace any workman whom the company considers incompetent or unsuitable and opinion of the company representative as to the competence of any workman engaged by the bidder shall be final and binding on the Bidder.

13.7 Repatriation and termination

PURCHASER shall reserves the right at any time during the currency of the contract, to terminate it by giving 30 days notice to Bidder, and upon expiry of such notice period the bidder shall vacate the site/office occupied by him immediately.

13.8 Indemnity agreement

Bidder shall exclusively be liable for non- compliance of the provision of any act, laws, rules and regulations having bearing over engagement of workers directly or indirectly for execution of work and the bidder hereby undertake to indemnify the company against all actions, suits, proceedings, claims, damages demands, losses, etc. which may arise under minimum wages act, payment of wages act, workman compensation act, personnel injury (compensation insurance) act ESI Act, Fatal Accident Act, Industrial Dispute Act, Shops and Establishment Act, Employees Provident Fund Act, Family Pension and deposit Linked Insurance Scheme or any other act or statutes not herein specifically mentioned but having direct or indirect application for the persons engaged under this contract. (A certificate to this effect shall be submitted by the bidder immediately on receipt of LOA).

13.9 Details of Penalty for non-performance of Staff

On Non-performance of Staff or deviation from Scope of Work, Client/Owner will intimate supplier / bidder/Contractor in form of 1st Notice. Bidder / supplier/Contractor will confirm the time for resolution.

Resolution time shall be agreed by both parties. If the issue is not resolved within time frame or

same issue is repeated, Client/Owner shall impose penalty as under:

a) Rs.100/- per Incident Day per personnel/Resource (Deployed by Contractor/Supplier/Bidder) penalty shall be imposed upon failure by the contractor/Supplier/Bidder to provide the necessary PPEs (I Cards, Dress Code/ Uniform / Safety Shoes / Hard hat/Safety Belt) to personnel/Resources and their failure to wear the same as specified by EIC.

b) Rs. 100/- per Incident for the non-compliance found in the log book readings of CNG Compressors.

c) Rs. 500/- per Incident for the untrained CNG Compressor operator is on duty.

13.10 Bidder's responsibility

The bidder shall depute his Supervisor for supervision of the services to receive instructions from Engineer-in-Charge or his representative.

13.11 Employment liability of Bidder

The bidder shall ensure and will be solely responsible for payment of wages and other dues latest by 7thof the following month to the personnel deployed by him in the presence of the Company's representative.

The bidder shall be directly responsible and indemnify the company against all charges, claims, dues etc. arising out of disputes relating to the dues and employment of personnel deployed by him.

The bidder shall indemnify the company against all losses or damages caused to it on account of acts of the personnel deployed by the Bidder. The bidder shall ensure regular and effective supervision of the personnel deployed by him.

The bidder shall be liable for making good all damages/losses arising out of loss or theft of each handled, leakage, pilferage of any office, furniture equipment fitting and fixtures what-so-ever as may be caused directly or indirectly by the engaged persons through him/work carried out by them.

13.12 General

The operation and maintenance services shall be provided in terms of shift pattern on the round the clock basis as mentioned in the tender document.

i) The bidder shall deploy adequate number of technicians / supervisors / Engineers / helpers as well as tools & equipment for smooth and proper operation & maintenance of the compressors supplied in terms of the contract. In case required to meet operational requirements, the bidder shall augment the same as per direction of Engineer –in-Charge.

ii) The bidder is required to carry out all services as mentioned in the Scope of Services and Schedule of Rates on all the 365 days including Sunday and all Holiday & around the clock.

iii) The bidder shall allow weekly rest and daily working hours to his workmen as per the relevant Act/Law/and Rule made thereunder. However, no work shall be left incomplete/unattended on any holiday/weekly rest. Technician/operators provided shall have minimum qualification of ITI. Contract in person or his authorized representative shall provide the services on daily

basis to interact with Engineer-in-charge and deployed workman

iv) The work force deployed by the bidder for O&M services at CNG installation shall be of sound relevant technical professional expertise which is otherwise

also essential from the safety point of view of the personnel of the bidder as well as for the installation.

v) Bidder has to ensure the safety of man and machine all the times. Damages of equipment due to negligence will be recovered as per the decision of Engineer- in-Charge, which will be final.

vi) Regarding work completion, the decision of the Engineer-in-Charge will be final and binding.

vii) The bidder shall make his own arrangements to provide all facilities like boarding and transport etc. to his workmen.

viii) All personnel of the bidder entering on work premises shall be properly and neatly dressed and shall wear uniform, badges while working on premises of the company including work sites.

ix) Bidder shall maintain proper record of his working employee's attendance and payment made to them.

x) The Bidder's representative/supervisor shall report daily to the Shift-in-Charge for day to day working.

xi) All the safety rules and regulations prevailing and applicable from time to time at the installations as directed by PURCHASER will be strictly adhered to by the Bidder.

xii) The rates quoted by the Bidder must be inclusive of all the taxes, duties, services tax, work contract tax and any other levies, Bidder's share of P.F. and insurance charges, Bidder's profit and any other expenditure etc.

xiii) It will be the responsibility of the bidder to pay as per the minimum wages of the appropriate government applicable under the Minimum Wage Act.

xiv) The services shall be provided in terms of shift pattern on the round the clock basis. The bidder is responsible to provide effective and efficient services in all shifts and assure that there is no disruption in the services for want of any resources.

xv) The bidder shall establish a complaint addressable mechanism available 24 hours, seven days a week where complaint regarding non-performance of the compressors in terms of the contract can be lodged. Further, to ensure immediate redressal of complaint round the clock manpower shall be made available, the bidder shall deploy adequate number of technicians/ supervisors / engineers at various site offices in consultation with Engineer-in-Charge to provide trouble free operation & maintenance of the compressors.

xvi) All arrangements for communication from control room to the contract person working on job under the services shall be the responsibility of the Bidder, viz smartphone.

xvii) All the jobs mentioned under scope of services shall be carried out as per sound engineering practices, work procedure documentation, recommendation of the manufacturer and as per the guidelines/direction of engineer-in-charge of authorized representative.

13.13 Operation and Maintenance of compressor packages as per Schedule of Rates

13.13.1 Scope of supply during warranty period:

All spares, consumables, lubricants, lubricating oil, coolant, sealant etc. required for carrying out the Operation and maintenance of the complete compressor package during the warranty period, including periodic, breakdown maintenance for continuous and uninterrupted operation of the compressor packages shall be in scope of the Bidder and shall be kept in stock. If any equipment got fire or broken due to accident the same shall be replaced or rectified by the bidder. Electricity shall be supplied free of cost to the Bidder.

13.13.2 Scope of supply during post warranty period:

All spares, consumables, lubricants, lubricating oil, coolant, sealant etc. required for carrying out the Operation and maintenance of the complete compressor package including major overhauling of compressor & engine during the post warranty period till contract validity, including periodic, breakdown maintenance for continuous and uninterrupted operation of the compressor packages shall be in scope of the Bidder and shall be kept in stock. If any equipment got fire or broken due to accident or in any way engine or compressor's major overhaul is required during breakdown the same shall be replaced or rectified by the bidder, at his own cost. Electricity shall be supplied free of cost to the Bidder.

13.13.3 Scope of services:

i. The Bidder shall have to keep all the spares, consumables, lubricants, coolant, etc required for carrying out periodic, breakdown, emergency maintenance etc of the

package so as to minimize the down time of the compressor. Non-availability of compressor package for non-availability of spares shall be liable for compensation.

All tools, tackles and fixtures required for carrying out the above maintenance of the compressor shall be in scope of the Bidder. The scope will also include handling equipment like crane, forklift, chain pulley block, etc required during the any maintenance activity.

ii. Any expert services required from principal company or OEM shall be arranged by the bidder or his agent at his own cost. All arrangements like phone, fax, computer, Internet etc required for correspondences with above personnel shall be arranged by the Bidder.

iii. The periodic maintenance required to be done as per OEM recommendation, inclusive of major overhaul maintenance, shall be taken up promptly. The Bidder shall provide the detailed preventative maintenance schedule along with the bid.

a) Estimated down time required for each type of maintenance schedule.
b) List of spares and their quantities required for each type of maintenance schedule per compressor.
c) Type and number of man days required for each type of maintenance schedule per compressor.

The bidder shall plan such maintenance during non-peak hours and in consultation with the Engineer In Charge (EIC) of Purchaser. Any maintenance that needs to be taken up, shall be well planned in advance with due approval of the EIC.

Note:- Major Overhaul Maintenance is defined as:
Highest mentioned maintenance interval in terms of running hours (as per OEM) in which inspection/testing or removal of crankshaft and crankshaft main bearing is recommended as per

OEM.

iv. The Bidder shall use only OEM's certified spares during maintenance. In case, the schedule maintenance of the OEM manual recommends checking and replacing parts like valve spring, valve plates, piston rings etc. after certain time interval, same shall be replaced or used further only on approval from the Purchaser representative. However any untoward consequences for non- replacement of such parts shall be the responsibility of the Bidder.

v. All routine and periodic checks / inspections required to be done as per OEM recommendation shall be done by the Bidder. Instruments required for above inspection like venire caliper, micrometer screw gauge, fill gauges, bore gauge etc shall be in scope of the Bidder and these instruments shall be calibrated every year.

vi. The bidder shall submit a copy of the daily / weekly / fortnightly / monthly / bimonthly / quarterly and yearly performance report to the EIC in both soft and hard form. All stationery including the printed material shall be in scope of the Bidder.

vii. All the maintenance / inspection job carried out by the Bidder shall be recorded and the report of the same shall be jointly signed by Purchaser representative.

viii. The EIC will be final authority to take decision with regards to maintenance or replacement of parts or any disagreement between the Bidder and Purchaser, during the execution of the contract.

ix. Calibration shall be done from government-approved laboratories and shall be carried out at least 15 days prior to the calibration due date.

x. The Bidder shall keep 1 set of safety relief valves in spare for the purpose of calibration. For total PR quantity of compressor packages.

xi. The Bidder shall carry out retesting of pressure vessels periodically as per Gas Cylinder rules 2016 or
Static & Mobile Pressure Vessels Rules.

xii. The periodic maintenance required to be done as per OEM recommendation shall be taken up promptly. The Bidder shall plan such maintenances during non-peak hours and in consultancy with the Engineer In Charge (EIC) of Purchaser. Any maintenance that needs to be taken up shall be well planned in advance with due approval of the EIC. The scope shall include preparation of maintenance schedule for carrying out the maintenance during the contract period.

xiii. In case, the schedule maintenance of the OEM manual recommends checking and replacing parts like valve spring, valve plates, piston rings etc. after certain time interval, same shall be replaced in the presence of Purchaser representative. If top overhauling of the compressor and prime mover is required as per compressor and prime mover manufacturer's O&M manual recommendation, the same shall be in bidder's scope.

However, all major overhaul required due to breakdown during AMC period shall be in bidder's scope.

xiv. Insurance of free issue items upto 15 days beyond commercial operation by purchaser or two months from the date of supply of equipment at site whichever comes earlier will be in the scope of bidder. The risks that are to be covered under the insurance shall include, but not be limited to the loss or damage in handling, transit, theft, pilferage, riot, civil commotion, weather conditions, accidents of all kinds, fire, war risk etc. After that the purchaser will arrange insurance for fire,

war, earthquake, civil commotion, riots and flood. Any other risk over and above will be in the scope of supplier.

14.0 GUARANTEED PARAMETERS (FOR 1200 SCMH & 600 SCMH COMPRESSORS):

14.1 SUCTION PR 16 KG/CM^2 (g); COMPRESSOR CAP. REQUIRED

SL NO	DESCRIPTION	By bidder
1	Compressor capacity in SCMH at suction pr.16 kg/cm2 (g) disch. pr 255 kg/cm2(g) and gas inlet temp 30^0 C (No -ve tolerance):	
2	Compressor BKW excluding (engine cooling fan , after cooler and inter cooler fan, lube oil pump, water pump etc. if applicable) at guaranteed condition in Kw (No +ve tolerance)	
3	Auxiliaries load (engine cooling fan , after cooler and inter cooler fan, lube oil pump, water pump etc. if applicable) in Kw (No +ve tolerance)	
4	Gas engine heat rate in Kcal/ kW hr (No +ve tolerance)	
5	Site rated BKW of gas engine at operating RPM (No -ve tolerance)	
6	Over all transmission efficiency %	
7	Kcal required by gas engine to drive compressor package per hour sl no {(2+3)*4/6)}	
8	Net CV of gas considered in Kcal/Sm3 : 8775	
9	Fuel gas consumed by gas engine in SCMH (basis of Loading and Penalty) : (No +ve tolerance)	
10	Noise level at 1 meter from enclosure (required 70 dBA max)	

14.2 SUCTION PR 17.5 KG/CM^2 (g); COMPRESSOR CAP. BY BIDDER

SL NO	DESCRIPTION	By bidder
1	Compressor capacity in SCMH at suction pr. 17.5kg/cm2 (g) disch. pr 255 kg/cm2(g) and gas inlet temp 30^0 C (No -ve tolerance):	
2	Compressor BKW excluding (engine cooling fan , after cooler and inter cooler fan, lube oil pump, water pump etc. if applicable) at guaranteed condition in Kw (No +ve tolerance	

3	Auxiliaries load (engine cooling fan , after cooler and inter cooler fan, lube oil pump, water pump etc. if applicable) in Kw (No +ve tolerance)	
4	Gas engine heat rate in Kcal/ kW hr (No +ve tolerance)	
5	Site rated BKW of gas engine at operating RPM (No -ve tolerance)	
6	Over all transmission efficiency %	
7	Kcal required by gas engine to drive compressor package per hour sl no {(2+3)*4/6)}	
8	Net CV of gas considered in Kcal/Sm3 : 8775	
9	Fuel gas consumed by gas engine in SCMH (basis of Loading and Penalty) : (No +ve tolerance)	
10	Noise level at 1 meter from enclosure (required 70 dBA max)	

14.3 SUCTION PR 19 KG/CM^2 (g); COMPRESSOR CAP. by BIDDER

SL NO	DESCRIPTION	By bidder
1	Compressor capacity in SCMH at suction pr. 19 kg/cm2 (g) disch. Pr. 255 kg/cm2 (g) and gas inlet temp 30^0 C (No -ve tolerance):	
2	Compressor BKW excluding (engine cooling fan , after cooler and inter cooler fan, lube oil pump, water pump etc. if applicable) at guaranteed condition in Kw (No +ve tolerance	
3	Auxiliaries load (engine cooling fan , after cooler and inter cooler fan, lube oil pump, water pump etc. if applicable) in Kw (No +ve tolerance)	
4	Gas engine heat rate in Kcal/ kW hr (No +ve tolerance)	
5	Site rated BKW of gas engine at operating RPM (No -ve tolerance)	
6	Over all transmission efficiency %	
7	Kcal required by gas engine to drive compressor package per hour sl no {(2+3)*4/6)}	
8	Net CV of gas considered in Kcal/Sm$_3$:8775	
9	Fuel gas consumed by gas engine in SCMH (basis of Loading and Penalty) : (No +ve tolerance)	
10	Noise level at 1 meter from enclosure (required 70 dBA max)	

Notes:

a) Bidder shall indicate the specific fuel consumption in KG/HR/BHP and the fuel consumption (above defined compressor capacity) in KG/HR as guaranteed value in the offer on the design case gas composition. The guaranteed value of fuel consumption of gas engine in KG/HR shall be between 34 to 36 KG/HR corresponding to flow of 1200 SCMH for the given gas and between 19 to 21 KG/HR corresponding to flow of 6 00 SCMH for the given gas. Bidder shall not be given any credit/advantage for quoting fuel consumption below the lower limit. But in case the fuel consumption quoted by the bidder exceeds the upper limit, the bid will be rejected.

Therefore bidders are requested to indicate the fuel consumption very carefully.
If any bidder quotes less than 34 KG/HR as fuel consumption by gas engine for running the 1200 SCMH Compressor, then 34 KG/HR will be considered as fuel consumption by the packager's calculation purpose.
Similarly, if any bidder quotes less than 19 KG/HR as fuel consumption by gas engine for running the 600 SCMH Compressor, then 19 KG/HR will be considered as fuel consumption by the packager's calculation purpose.

b) For calculation purpose, fuel consumption corresponding to guaranteed parameters of 1200 SCMH & 600 SCMH Compressors at 16 kg/cm2(g) suction pressure shall be considered.

15.0 GAS COMPOSITION:

The expected gas composition at City Gas distribution Network is as shown below

S. No.	COMPONENT	AVG. GAS COMPOSITION (mol%)
1	Nitrogen	0.3505
2	Methane	94.6591
3	CO2	0.5502
4	Ethane	2.3547
5	Propane	1.0458
6	i-Pentane	0.2135
7	n-Butane	0.3223
8	i-Pentane	0.1427
9	n-Pentane	0.1414
10	n-Hexane	0.2199
11	GCV	9721.00
12	NCV	8775.00
13	Specific Gravity	0.59 - 0.625

NOTES:

- O_2 not more than 0.5% mole. Total non-hydrocarbon not more than 2.0%.
- Total S including H_2S not more than 10 ppm by weight.
- H_2S not more than 4 ppm by volume.
- Moisture : No Free water

16.0 CLIMATE

A. HYDERABAD

- Minimum ambient temperature : 5 Deg.C
- Maximum ambient temperature : 50 Deg.C
- Relative Humidity : 94% Max.
- Altitude above mean sea level : 100-601 m
- Wind velocity : NA

B. VIJAYAWADA

- Minimum ambient temperature : 4 Deg.C
- Maximum ambient temperature : 50 Deg.C
- Relative Humidity : 90% Max.
- Altitude above mean sea level : 100-540 m
- Wind velocity : NA

C. KAKINADA

- Minimum ambient temperature : 5 Deg.C
- Maximum ambient temperature : 45 Deg.C
- Relative Humidity : 95% Max., Non condensing
- Altitude above mean sea level : 2-100 m
- Wind velocity : 120 km/hr

17.0 DATA SHEETS OF COMPRESSOR

17.1 Data Sheet of Main Compressor:

1	**General:** ■ Means required □ Means bidder shall indicate; If not indicated, shall be filled by the bidder	
2	**Project:** City Gas Distribution Network at Hyderabad, Vijayawada & Kakinada	
3	**Owner:** Bhagyanagar gas Limited	
4	**Service:** CNG compressors	
5	**No. Required:** As per MR	
6	**Compressor capacity:** 1200 SCMH / 600 SCMH	**Driver:** Gas Engine
	Note: ■ Scope option / information specified by purchaser □ Information required from vendor	
7	☐ **Manufacturer:**	☐**Model No.:**
8	☐**Place of manufacture:**	
9	☐**No. of stages:**	☐**Cylinder arrangement:**
10	☐**Cylinder Lubrication**: Lubricated /Minimum lubricated/Non Lubricated	
11	■ **Driver type:** Gas Engine	
12	☐**Drive:** V belts(Anti-static type) / Direct with coupling	
13	☐**Direction of rotation (Facing driven end):** Clockwise / Counter clockwise	
	■ **Site installation data**	
14	**Ambient temp.(^{0}C):** As indicated in CL 16	

15	**Relative Humidity (%):**As indicated in CL 16				
16	**Altitude (m):** As indicated in CL 16				
17	**Earth quake zone:** III		**Wind velocity (m/s):** As indicated in CL 16		
18	**Installation:** Outdoor				
19	■Mounted on a common skid along with driver, enclosed inside an acoustic enclosure				
	■Electrical area Hazard				
20	Class 1, Group D, Division1 as per NEC or Zone 1,Group IIA/IIB as per IS/IEC				
	Applicable Codes and standards				
21	**Compressor:** ISO 13631-2002		**Piping:** ANSI/ASME B31.3		
22	**Pressure Vessels:** ASSME Sec VIII, Div-1		**Gas cooler:** API 661		
23	**Oil cooler:** TEMA 'C'/Manufacturer's std. design		**Sound:**70 dBA @ 1m from enclosure		
24	□Aux. Elect. Motors:				
25	**Control panel & instrumentation:** Refer technical specification				
	Utilities data				
26	□Cooling water (Not Available)				
27	☐**Type:** ☐**Supply temperature (^{0}C) :** ☐ **Max. Return temperature:**				
28	☐**Fouling Factor:** ☐**Supply pressure(Kg/cm^2(g):** ☐**Min. return pressure(Kg/cm^2(g):**				
29	☐**Design pressure(Kg/cm^2(g):** ☐**Design temperature(^{o}C):**				
30	☐**Water Flow rates (m^3/hr):**				
	☐**Electricity**				
31	**Auxiliary motors** **V:** **Ph:** **Hz:**				
32	**Oil Heaters (If required)** **V:** **Ph:** **Hz:**				
33	**Solenoid valves** **A.C/D.C:** **V:** **Ph:** **Hz:**				
34	**Instruments** **A.C/D.C:** **V:** **Ph:** **Hz:**				
35	**Local panel-Indi/Alarm/Ann.** **A.C/D.C:** **V:** **Ph:** **Hz:**				
36	**Local panel-Trip circuit** **A.C/D.C:** **V:** **Ph:** **Hz:**				
37	**UPS** **KVA:** **V:** **Ph:** **Hz:**				
	☐**Total utility consumption**				
38	**Cooling water (make up)(m3/hr):**				
39	**Power(Auxiliaries)(kW):**				
40	**Power(Heaters)(kW):**				
	Remarks: Vendor/Bidder should estimate the requirement for all the utilities and indicate the same in tabular form				
	☐**Construction/Design features:**				
41	Nomenclature	Unit	Stage#1	Stage#2	Stage#3
42	Cylinders				
43	No. of cylinders	No.			
44	Single acting(SA)/double acting(SA)				
45	Cylinder Bore/stroke	mm/mm			
46	Rotational speed	RPM			
47	Linear average piston speed	m/sec			
48	Piston displacement	m3/hr			
49	Cylinder liner (yes/No)				

50	Type of cylinder liner: Dry/wet				
51	Clearance pockets: Yes/No				
52	Max. Allowable working pressure, Cylinder	Kg/cm2(g)			
53	Max./Min. Allow. Working Temp., Cylinder	^{o}C			
54	M. A. W. P. Cylinder @ Amb. temp.	Kg/cm2(g)			
55	Safety valve set pressure, cylinder	Kg/cm2(g)			
56	G Helium test pressure, cylinder	Kg/cm2(g)			
57	Hydrostatic test pressure, cylinder	Kg/cm2(g)			
58	Cylinder jacket cooling type as reqd.				
59	Cooling media, cylinder jackets: Water/air				
60	Max. Allow. Working pressure, cyl. Jacket.	Kg/cm2(g)			
61	Hydrostatic test pressure, cylinder jacket	Kg/cm2(g)			
62	Suction nozzle size/ rating/ position				
63	Discharge nozzle size/ rating/ position				
64	Suction valve number				
65	Average gas velocity	m/sec			
66	Discharge valve number				
67	Average gas velocity	m/sec			
68	Type of suction valve				
69	Type of discharge valve				
70	Suction valve unloaders yes/no				
71	Clearance pockets unloaders type				
72	Piston rod diameter	mm			
73	Rod reversal at crosshead pin (min.)	mm			
74	Piston rod run out operating				
75	Max. Allow. Rod load comp.	kg			
76	Tension	kg			
77	Rod load at R.V set comp.	kg			
78	Distance piece/packing				
79	Type of packing				
80	Packing vent connected to ##				
81	Packing cooling				
82	Type of distance piece				
83	Cyl. Side compartment purged				
84	Frame side compartment purged				
85	Distance piece purge gas pressure	Nm3/hr			

86	Distance piece vent to		Safe height	Safe height	Safe height
87	Distance piece hydrostatic test pressure	Kg/cm2(g)			
	## it should be connected to vent header of the package				
	Frame				
88	Replaceable cross head shoes: yes/no				
89	Cross head guide: Integral/separate				
90	Maximum frame rating	kW			
91	Speed- Maximum /minimum	RPM			
	☐**Lubrication system**				
92	Type of lube system			Piping material: CS/SS	
93	Main oil pump driven by:			Auxiliary oil tank:	
94	Stand by oil pump driven by:				
95	Hand operated prelube / priming pump			Oil grade:	
96	Suction strainer:			Lube oil consumtion:	
97	Pressure control valve:			Main pump-make: model: Type: material:	
98	Level sight glass on the crankcase				
99	Type of oil cooler:			Standby pump-make: model: Type: material:	
100	Size of filter				
101	Oil heater (If required):				
102	Electric heater with thermostat (KW):				
103	Thermostatic valve				
104	Type of Cylinder Lubrication:			Lubricator Equipped With :	
105	Lubricator Type: Manzel or Equivalent.			Level sight glass:	
106	Single plunger per feed:			Oil heater electric with thermostat:	
107	Divider blocks type.:			Electric Heater (Kw) (if required)	
108	Lubricator Driven By :			Auxiliary Oil Tank (if required):	
109	Compressor Shaft:			Oil Grade :	
110	Lube oil Electric Motor KW:			Oil System Capacity: (min 30 Hrs.)	
111	All tubing and valves in SS			Oil Consumption. Rate	
112	Double Ball Check valve on each lubrication point				
	□ **Cooling System**				
113	□ **Static filled coolant system for**				
114	□All Stage Cylinders				
115	□Including expansion chamber, Vents, Drains, Level Gauge, Piping, etc.				
116	All Piping prefabricated □ Material				
	□**Atmospheric thermosyphon cooling system for**				
117	□All Stage Cylinders				
118	□Including expansion tank, Vents, Drains, Coolers, and Level & Temp. indicators, Piping, etc.				
119	All Piping prefabricated. □ Material:				
	□**Forced Cooling Water System for**				
120	□All Stage Cylinders				
121	□ Packings		□ Oil Coolers		□ Gas Coolers
122	□ Including drains, Vents, flow & temp. Indicators, regulating & Isolation valves, complete piping to provide one				

123	□ Common inlet and one common outlet connections for Purchaser's interface terminated by a flanged block valve			
124	□ Block valve.			
125	□ Each isolatable circuit to be provided with thermal relief valve.			
126	All Piping prefabricated. □ Material			
	☐ **Self-contained, forced circulation, closed circuit Cooling Water System (if reqd.) for**			
127	□All Stage Cylinders			
128	□ Packing □ Oil Coolers □ Gas Coolers			
129	□ Including drains, Vents, flow & temp. Indicators, Temp. Control Valve, Regulating & Isolation valves, complete piping			
130	□ Main circulating pumps with drivers & suction strainers □ Single Coolers			
131	□ Reservoir (Make Up): □ Heater (if required)			
132	□ Pumps, Reservoirs, Coolers etc. to be mounted on a common skid as to make a separate console.			
133	□ Material of piping:			
134	□ Type of coolant:			
135	□ Jacket cooling			
136	□ Gas Piping System:			
	Vendor's Supply Includes:			
137	■ Separator			
138	■ Pulsation suppression equipment as per 'next' page			
139	■ Suction Filter:			
140	■ Strainer on Compressor Suction for start-up			
141	□ Type of Strainer:			
142	■ Relief Valves: on compressor ■ suction ■ Inter-stage ■ on compressor discharge			
143	■ Check Valve on Discharge Line (compressor valve design, and suction line)			
144	■Process Gas Coolers Complete With Manual Drain Valve			
145	■Separators Complete With Automatic Drain Values			
146	■ Process Gas Piping			
147	■Supply starts at inlet flange of CNG PACKAGE			
148	■Terminates after priority panel with isolation valve			
	□ **Materials:**			
149	□ By-Pass Line Piping			
150	□ Between			
151	□ Gas cooler			
152	□ Interconnecting Piping Between Packing Vents, PSV Relief terminating to Vent Recovery System.			
153	□ Interconnecting piping between distance piece terminating to Vent Recovery System up to package B/L			
154	□ Interconnecting piping between Drains terminating as a single point			
155	□ Interconnecting piping between Instrument Air terminating			
156	□ Pulsation Suppression Equipment			
	Stage#	Stage#1	Stage#2	Stage#3
	Suction			
157	Puls. Equipment Required : yes/no			
158	Inlet pressure			
159	Residual peak to peak pulsation %			
160	Inlet nozzle size / rating /position			
161	Discharge nozzle size / rating /position			
162	Design pressure, kg/cm2(a)			
163	Design temperature, kg/cm2(a)			
164	Volume			
165	Material of vessels	SA516 Gr.70	SA516 Gr.70	SA516 Gr.70

166	Internals				
167	Corrosion allowance, mm		3	3	3
168	Hydrostatic test pressure, kg/cm2(g)				
	Discharge				
169	Puls. Equipment Required : yes/no				
170	Inlet pressure				
171	Residual peak to peak pulsation %				
172	Inlet nozzle size / rating /position				
173	Discharge nozzle size / rating /position				
174	Design pressure, kg/cm2(a)				
175	Design temperature, kg/cm2(a)				
176	Volume				
177	Material of vessels				
178	Internals				
179	Corrosion allowance, mm				
180	Hydrostatic test pressure, kg/cm2(g)				
181	Design code: ASME Sec. VIII Div.I				
182	■ Automatic Drain Valves For Each Stage suction KOD				
183	□ Capacity Control				
184	■ Start / Stop, based on discharge receiver pressure: Fully Automatic				
185	Unloading for Start-up/Shut down :Automatic Through □ Valve Unloader □ Recycle Valve				
186	■ Interlock against loaded start				
187	■ Automatic Control based on				
188	□ Suction Pressure ■ Discharge Pressure □ Flow Manual Signal				
189	□ Type of Actuator □ Actuation fluid to load □ Actuation fluid to unload				
190	■On Power / Actuation fluid failure : Compressor to □ Load ■ Unload				
191	■ Continuously □ Maximum Hrs.				
192	□ Continuously □ Maximum Hrs.				
193	■ At All other capacity, Compressor should run continuously				
	Vendor's scope Should Include :				
194	■Pilot Devices (pressure / temperature / Flow devices ,Controllers & Switches)				
195	□ Intermediate Devices (Solenoid Valves | Pneumatic Relay / Valves)				
196	■ Actuators				
197	□ Recycle valves				
198	□ Control Logic and System for Complete Capacity Control				
199	■ Inter Connecting Tubing, Piping, Cabling & Wiring				
200	■ Protection against extended unloaded operation (Trip)				
201	□ Valve unloaders are required as such Compressor should start / stop at specified receiver pressures.				
	□**Purchaser's Interface**				
202	Type of Interface (Single Point)	Size	Rating	Face	Position/Location
203	Main Gas Piping Inlet				
204	Main Gas Piping Outlet				
205	Relief Valves discharge				
206	Distance Piece Vent				
207	Packing Vent				
208	C.W. Inlet				
209	C.W. Outlet				
210	Drains				
	MATERIALS				

211	Cylinder materials			
212	Stage	1st stage	2nd stage	3rd stage
213	□Cylinder			
214	□Liner			
215	□ Piston			
216	Piston Rings	PTFE	PTFE	PTFE
217	Rider Rings	PTFE	PTFE	PTFE
218	□ Piston Rod			
219	□ Packings Rings			
220	□ Valve Seats			
221	□ Valve Stops			
222	□Valve Rings / Plates			
223	□Valve Springs			
224	□ Cylinder Head			
	Motion Work Materials:			
225	Item	Material/ASTM Grades		
226	Top Cover			
227	Crankcase			
228	Crankshaft			
229	Connecting Rods			
230	Cross heads			
231	Cross Head Shoes			
232	Cross Head Guide			
233	Main Bearings Type			
234	Cross Head Pin Bearings Type			
235	Connecting Rod Bearings Type			
236	Cross Head Pin Type			
237	Each package should be provided with two number drain lines, one from Suction KOD and second drain as common drain line from intermediate and discharge KOD routed to drain vessels through gas recovery vessels			
	CONTROLS & INSTRUMENTATION			
238	■ AC Power On/Off Switch With Indication Lamp			
239	■ Control Power On/Off Switch With Indication Lamp YES			
240	■ Selector Switch A/M Station For L/O Pump Motor			
241	■ Selector Switch A/M Station For CW Pump Motor			
242	■ Emergency Stop Push Button			
243	■ Start Push Button For Air Compressor Motor			
244	■ Emergency Stop Push Button for Gas Engine			
245	■ Lamp Test Push Button			
246	■ Alarm / Trip Acknowledge / Reset Push Button			
247	■ Frame Oil Heater ON (Indicating lamp)			
248	■ Lubricator Oil Heater ON (Indicating lamp)			
249	■ Interlock Against Loaded Start			
255	■ Interlock Against Start Without Pre-lubrication			
	Notes :			
	Minimum required indications, alarms & trips are shown herewith. Bidder should provide any additional instrumentation for safe operation.			
	Compressor should start/ stop at pre-determined receiver pressure as specified. Bidder should include in his Scope necessary hardware for the same			
	INSPECTION AND TESTS			
251	Material Composition and Physical Properties Certificates Required For:			
252	■ Cylinder and Liner ■ Piston			

253	■ Crankshaft ■ Connecting Rod		
254	■ Pressure Vessels ■ Heat Exchangers		
255	■ Radiography Examination for components: Pressure Vessels (certificates to be furnished).		
		By bidder	Witnessed
256	■ Mech. Running & string test with job Driver (4 Hours min.)	■	■
257	■ Performance Test at site	■	■
258	■ Functional/Continuity Tests - Control Panel.	■	■
259	■ Field Trial Run ,under Vendor's Supervision (Package)	■	■
260	■ Valve Leak Test	■	□
261	■ Lube Oil Console Run test	■	□
262	■ Closed Circuit C.W. System test	■	□
	During package performance test Required For:		
263	■ Auxiliary Motor & Pumps ■ Safety Relief Valves		
264	■ Safety Switches ■ Solenoid Valves		
265	□ **WEIGHTS**		
266	Overall supply (excluding driver and gear box, if any) Kg. approx.		
267	Maximum erection weight Kg. approx.		
268	Maximum maintenance weight Kg. approx.		
269	Gear Box Kg. approx.		
270	Driver Kg. approx.		
	SCOPE OF SUPPLY		
271	■ Compressor Assembly complete with frame, cylinders, cross head etc.		
272	■ Motion work lubrication system		
273	■ Cylinder and packing lubrication system		
274	■ Cooling system		
275	■ Process Gas system		
276	■ Local instrumentation		
277	■ Local Gauge Board		
278	■ Local Control Panel ■ PLC Panel ■ Human Machine Interface located on skid		
279	■ Main driver		
280	■ Barring Device: ■ Manual ■Electric. ■Pneumatic		
281	■ Flywheel		
282	■ V-Belts with Pulley		
283	■ Couplings		
284	■ Driver Compressor		
285	■ Guards for moving parts		
286	■ Base plate Common for Compressor and Driver		
287	■ Fabricated Steel skid Common for compressor, driver and accessories		
288	■ Ladders and platforms		
289	■ Special Tools - One Set for each package		
290	■ Anchor Bolts for Complete Package		
291	■ Piping supports and brackets : ■ prefabricated for piping in Vendor's Scope		
292	■ Supports For Cylinders & Auxiliaries, Prefabricated & fitted in the Package		
293	■ Commissioning Spares, erection and commissioning spares		
294	■ Spares as specified in the Job Specification		
295	■ Vendor Data as specified		
296	NOTE : Refer check list for scope of supply		

17.2 DATA SHEET OF HEAT EXCHANGERS FOR COMPRESSOR'S PACKAGE:

1	**General:** ■ Means required □ Means bidder shall indicate; If not indicated, shall be filled by the Bidder
2	**Project:** City Gas Distribution Network, Hyderabad, Vijayawada & Kakinada
3	**Owner:** Bhagyanagar gas Limited **Site:** Hyderabad, Vijayawada & Kakinada geographical area
4	**Service:** Intercooler / After cooler for compressor package
5	□**No. Required:**
6	□Manufacturer □ Type: forced draft/Induced draft
7	□Bundle size: m x m x m □ Bundles/section: □Number of units:
8	□ Bundles/unit: □ In parallel/series: □Section size:
9	□ Surface area/Bundle:m2 □Bare tube: m2 □Section/unit:
10	□ Surface area/unit:m2 □Bare tube: m2 □Plot area/unit:
	Performance (of one unit)
11	□Heat exchanged: kcal/hr □MTD(Corrected):^{o}C
12	□Transfer rate: kcal/hr m2 ^{o}C □ (Finned surface): □ (Bare surface):
	Tube side
13	■Fluid circulated: Gas Sp. Gravity:
14	■Total entering gas ,kg/hr: As per TS ■Enthalpy/Latent heat kcal/kg: As per gas composition
15	□Operating temperature(^{o}C) In: Out: Fouling resistance, hr m2 ^{o}C/kcal:
16	□Operating pressure passes/bundle, kg/cm^2
	Air side
17	■ Temperature (^{o}C) In: 45 □Out: ■ Altitude,m: As indicated in CL 16
18	□Total flow/unit, kg/hr □ Static pressure, kg/cm2
19	□Quantity/fan, kg/hr □ Power/fan, kW
20	□Face velocity, m/sec □ Power/unit, kW
	Construction (Each bundle)
21	□Design pressure, kg/cm2g □ Test pressure, kg/cm2g: □ Design temperature, ^{o}C:
22	□Code requirements
23	□Type of tubing: □Tube material: ■Fin material: Al
24	□Tube Bare tubes(nos.): □No. of rows, O.D: □BWG/Thk.: □Length:
25	□Fins: spacing/inch. O.D: □Root dia.: □Thickness.:
26	■Header type: Plug/cover □No. of splits: □Material
27	□Plugs/gaskets ■Side frame: C.S. Inside Zinc protected
28	□ Nozzles □ In : □ Out :
29	□ Coupling □ Vent: □ Drain :
	Construction (Each section)
30	■Structure CS□ Sec. /Gr. No.: □ Design Wind Load : kgf/m
31	■ Plenum Chamber CS inside Zinc Protected Type :
32	□ Fans No. Dia. RPM Mfr.
33	□ Blades Material : No./Fan Pitch Angle(Design) :
34	□ Hubs Material: Pitch: Auto / Adjustable (No.)
35	□ Louvers Material : Type : Mfr.
36	□ Weights kg Each Section(Dry) : Full of Water:
37	□ Each Bundle (Dry) : Full of Water:
	■ APPLICABLE SPECIFICATIONS API Standard 661
38	■ REMARKS 1. Air coolers should be designed for 20% excess capacity than required normally.
39	■ Exchanger should be designed with air side temperature of 44^{o}C.
40	■ Separate data sheet should be filled by the bidder for each service i.e. Inter cooler and After cooler

18.0 DATA SHEET OF GAS ENGINE: (IF NOT INDICATED SHALL BE FILLED BY THE BIDDER)

1	**General:** ■ Means required □ Means bidder shall indicate; If not indicated, shall be filled by the bidder	
2	**Project:** City Gas Distribution Network, Hyderabad, Vijayawada & Kakinada	
3	**Owner:** Bhagyanagar gas Limited	
4	**Service:** Driver for CNG compressors	
5	**No. Required:** One for each unit as per MR	
	Note: ■ Scope option / information specified by purchaser □ Information required from vendor	
	■ Site installation data: Hyderabad, Vijayawada & Kakinada geographical area	
6	**Ambient temp.(ºC):** As indicated in CL 16	
7	**Relative Humidity (%):**As indicated in CL 16	
8	**Altitude (m):** As indicated in CL 16	
9	**Earth quake zone:** II	**Wind velocity (m/s):** As indicated in CL 16
	■Electrical area Hazard	
10	Class 1, Group D, Division1 as per NEC or Zone 1,Group IIA/IIB as per IS/IEC	
	Utilities data	
11	□Cooling water (Not Available)	
12	□Cooling water Temp. (ºC): □Supply temperature (ºC) (Design/Max/Nor./Min.) : □ Max. Return temperature:	
13	□Cooling water pr. (Kg/cm2 (g): □Supply pressure (Design/Max./Nor/min.) (Kg/cm2(g): □Min. return pressure(Kg/cm2(g):	
14	Cooling water characteristics:	
	□ **Instrument air:**	
15	□Supply pressure (Design/Max./Nor/min.)(Kg/cm2(g):	
	□**Electric power**	
16	Electric supply: A.C/D.C: V: Ph: Hz:	
	Applicable codes & standards	
17	■Noise specification: Applicable to M/c Max.70 dBA @1.0m outside the acoustic enclosure.	
18	■Exhaust gas emission: Statutory requirements as per Karnataka and Andhra State Pollution Control Board	
19	■Listing/approval of engine required from : ■UL/FM □TAC	
20	■Air receiver for starting air system: ASME Sec. VIII, Div. I □Air compressor for starting :Air system as per manufacturer's standard for air starter with silencer	
21	□Shell and tube type exchangers: Manufacturer's std. □Auxiliary pumps: Manufacturer's std.	
22	□Air cooled heat exchangers/radiator: Manufacturer's std. □Other tanks and vessels: Manufacturer's std.	
	Driven equipment	
23	■Reciprocating compressor	
24	■Duty: Intermittent	
25	Probable period for continuous running: 20 hrs. with frequent starts and stops	
26	■Duration of max load/day: 20 hours	
27	□Minimum BKW of Driven equipment, kW @RPM :	
28	□Rated BKW of Driven equipment, kW @RPM :	
29	□Maximum BKW of Driven equipment, kW @RPM :(@R.V. set pr.)	
30	□ For mech. drive applications: Minimum site rating of the engine required kW @ RPM	
31	□ Accounting for engine deration for site conditions & alternator efficiency with engine driving its all auxiliaries.	
32	□ Direction of rotation of driven equipment viewed from coupling end :	
33	□ Method of drive: Direct thru flexible coupling or V-belts	
	Construction features	

34	□ Manufacturer:		□ Engine model:		
35	■Type of engine: Four-stroke		■Engine cooling : Water cooled		
36	□Turbo-charged with charge air cooler		□ Normally aspirated		
37	□ No. of cylinders:		□ Cylinder arrangement:		
38	□ Bore/stroke (mm/mm):		□ Compression ratio:		
39	□ Speed (rpm):		□ mean piston speed (m/sec.):		
	□ Performance				
40	Rated engine power at standard operating conditions as per iso 3046/ bs 5514 (ISO std. power): kW @ RPM (Using only the essential dependent auxiliaries and with 10 % overload provision				
41	Rated engine power at site conditions guaranteed, no negative tolerance): KW @ RPM (using the essential dependent auxiliaries and with 10 % overload provision				
42	Min. engine site power at, which engine can be operated continuously. Kw @ rpm				
43	Min. engine speed & corresponding site power at which engine can be operated continuously. Rpm @ kw:				
44	Starting time required for full load operation (seconds):				
45	Air flow required for operation of the engine for: □ Combustion & scavenging □ Cooling & ventilation of enclosure □ Air coolers				
46	Essential dependent auxiliaries are:				
47	Engine shaft driven radiator fan: kw				
48	Engine shaft driven CW pump: kw				
49	Engine shaft main lube oil pump: kw				
	□ Specific fuel consumption:				
50	Description : Fuel consumption, gm/kw - hr @ reference conditions *:				
51		ISO 3046*	Manufr's. Std.*	Site *	Manfr's. Shop *
52	(A) Guaranteed engine rated power (100% continuous rating)				
53	(B)75% of (A)				
54	(C)50% of (A)				
55	(D)110% of (A)				
56	* Standard Reference Conditions:				
57	Total Barometric pressure, ,kg/cm^{2}a				
58	Atmospheric Temp. ^{0}C				
59	Relative Humidity , %				
60	Charge air &coolant temp ^{0}c				
61	□ Speed governing system:				
62	Type: □Single speed: □Multiple speed: □All speeds:				
63	Governor type: □Electronic: □Electro Hydraulic: □Mechanical:				
64	■Make: Woodward □Model:				
65	□Governor control mechanism: □Manual/Remote:				
	Starting system				
66	■Method of starting: Automatic				
67	■Method of stopping: Automatic				
68	□Type of cold starting: (Considering min. Ambient temp.)				
69	■Type of starting system: Air starting				
	Remarks:				
70	Bidder should engineer and supply the complete air starting mechanism including air compressor, air receiver.				
71	The purchaser shall provide electricity for air compressor motor.				
72	■Starting air system to be placed outside the enclosures)				
73	■Air compressor type: Reciprocating				
74	□Rated capacity (m3/hr at inlet conditions):				

75	□Discharge pressure (kg/cm2g):
76	□BKW : □RPM:
77	■Air compressor driven by: Electric motor
78	□Driver rating □KW: □RPM: □Volts/N/Hz :
79	■Air receiver with pressure gauge, relief valve & manual drain valve
80	■start-stop switch for compressor: Automatic:
81	□No. of air receivers: Capacity of receiver:
	■Cooling system:
82	Type: Closed circuit cooling
83	Water pump driven by: Engine
84	Coolant circuit piping with Temp. control & make-up tank
85	Heat exchanger with anchor/ foundation bolts: Air cooled exchanger
86	By-pass valve: Check valve:
87	Heat exchanger, Temp (°C)-Inlet/outlet:
88	■Fan driven by: Driver □Rating/speed(kW/RPM):
89	□Engine water temp.(°C)-Inlet/outlet:
90	Packager may club the engine jacket and compressor cylinder cooling water system with engine shaft or compressor shaft driven pump.
	■Frame lubrication system:
91	■Type: Force feed lubrication including valves, oil pump & piping
92	□Oil cooler type: Air cooled/Water cooled
93	□Oil filters: Self-cleaning/ Duplex/paper cartridge
94	□Pre-lube oil pump driven by (If required)
95	□Pre-lubrication: Manual/Automatic
96	□Type/grade of lube oil:
97	□Oil consumption(lph):
98	□Oil sump capacity (litres):
99	□Oil cooler testing pr. Kg/cm2(g)
100	□Explosion relief valve for crank case
	■Air inlet system
101	■Suction air filter ■Air inlet ducting/piping/Manifolds □Inlet silencer
102	Expansion bellows (if required) & all supports/hangers
	Engine exhaust system
103	■Exhaust manifolds / ducting / piping terminated at safe height outside engine enclosure through exhaust silencer (residential type)
104	■ Expansion bellows ■ Exhaust stack / chimney ■ All supports / hangers ■Protection insulation for complete exhaust piping
105	□ Provided as above: Yes/No
	□ Controls & Instrumentation
106	Electric supply:
107	Lamps: ± V: AC/DC: N: ± HZ:
108	Alarm circuit: ± V: AC/DC: N: ± HZ:
109	Trip circuit: ± V: AC/DC: N: ± HZ:
110	Control circuit: ± V: AC/DC: N: ± HZ:
111	Solenoid valves: ± V: AC/DC: N: ± HZ:
112	Control switches:
113	■ Ac power on/off switch with indication lamp
114	■ Control power on/off switch with indication lamp
115	■ Start switch with indication yes
116	■ Start/stop push button for aux. drive motor
117	■ Emergency stop push button

118	■ Lamp test push button
119	■ Alarm/trip acknowledge /Reset push button
120	■ Lubricating oil heater `on' indicating lamp (if provided)
121	■ Interlock against start without pre-lubrication
122	Note: Vendor to provide contact/signal for execution in DCS.
	□ Material
123	Charge air cooler Shell: Tubes:
124	Water cooler Shell: Tubes:
125	Air cooler Shell: Tubes:
126	Air receiver
127	Inspection and Testing
128	■Witness □Observe by supplier
129	□ stage inspection during manufacture
130	□ Full load test at engine manufacturer's shop as per ISO(Performance test)
131	□ Fuel consumption & governing test at engine manufacturer's shop as per ISO
132	□ Full load test for 4 hrs for gas engine with all auxiliaries & 1 hr @ 110 % load at site.
133	■ No load mechanical run test at packager's / driven equipment mfr. shop
134	■ Vendor's standard mechanical run test (for all engine)
135	□ Weights
136	Net weight of engine with mounted ancillaries (kg):
137	Heaviest part to be handled during erection and its weight (kg):
138	Heaviest part to be handled during normal maintenance and its weight (kg):
139	Recommended crane capacity (tons): Crane hook height(m):
	□ Maintenance data
140	Expected period of running between top overhauls: hours
141	Expected period of running between main overhauls: hours
142	The type and grade of lubricating oil recommended:
143	Lube oil consumption (kg/hr)/ (litres/hr):
144	Change of lubricating oil after: hours
	■Scope of supply / work
145	Engine with lubrication system, governing system, fuel system, cooling system and starting system as specified
146	Suction air filter with suction piping
147	Instruments and controls as specified
148	Inlet and exhaust manifolds, exhaust piping with fillings, bends and insulation
149	Exhaust silencer (residential, spark arresting type) with expansion bellows and complete with exhaust piping from
150	Manifold to outside shed with fittings and insulation.
151	Flywheel with barring device
152	Guards for moving parts
153	Coupling for engine - driven equipment
154	Base plate for engine & driven equipment
155	Spares as per order
156	Erection and commissioning spares

157	Torsional analysis report on engine
158	Refer technical specification for complete scope of supply
159	Foundation/ anchor bolts (If required)
160	Anti-vibration pads
161	First fill of lubricating oil and coolant.
162	Acoustic enclosure with forced ventilation fan

19.0 DATA SHEET OF AIR COMPRESSOR MOTOR:

(if not indicated shall be filled by the bidder)

1	Project name:	City gas distribution network, Hyderabad, Vijayawada & Kakinada
2	Driven equipment	Air Compressor
3	Tag No. / Equipment No.	
4	Duty	
5	Manufacturer	
6	Motor Duty & Type	
7	Frame Size/Mounting	
8	Output _____KW	
9	Voltage _____VOLT	415 V+/ - 10%
10	Full load current_____AMP	
11	Starting current with star delta starting AMP	
12	Full load speed _____ RPM	
13	Enclosure	TEFC/FLAMEPROOF/IP55 AS PER IS:4691:1985, IS :12615:2011, IS: 2148
14	Mounting	
15	Insulation Class	F' - Temp. rise limited to Class - 'B'
16	Ambient temperature _____°C	
17	Temp. Rise by resistance _____ °C	
18	Applicable Code	
19	Full load torque _____ Kg-m	
20	Starting torque _____FLT	
21	Efficiency at _____100% Load	
	_____75% Load	
	_____50% Load	
22	Rotation viewed from DE	
23	Bearing type No.	
24	Type of Lubrication	
25	Coupling / pulley	DIRECT / FLEXIBLE
26	Net weight (approximate) _____kg	
27	Cable size / type _____mm sq.	
28	Phase / connection / No. of terminal	
29	Frequency _____Hz.	50 Hz + / - 5%
30	No. of poles _____	
31	Locked rotor current_____%FLC	
32	LR withstand time (HOT) _____Sec	
	(COLD) ----------Sec	
33	Stator / rotor time constant _____Min	
34	Power factor at - 100% Load	

	- 75% Load	
	- 50% Load	
35	Break down or pull out torque ___%FLT	
36	Space heaters _____WATT / VOLT	
37	Vibration Level / Noise Level	As per IS12065 / IS12075

20.0 DATA SHEET OF DETECTORS & METERS

20.1 DATA SHEET IR-GAS DETECTION (LEL) SYSTEM

(if not indicated shall be filled by the bidder)

1	**GENERAL: ■ Means required □ Means bidder shall indicate; if not indicated shall be Filled by the bidder**	
2	**Project:** City Gas Distribution Network, Hyderabad, Vijayawada & Kakinada	
3	**Owner**: Bhagyanagar gas Limited	Site: **Hyderabad, Vijayawada & Kakinada Geographical Area**
4	**Equipment:** Gas detection For CNG stations	
5	**No.:** 2 nos. for each package	Gas detection type:
	Note: ■ Scope option / information specified by purchaser □ Information required from vendor	
6	□ Manufacturer:	□ Model No.:
7	Signal transmission	
8	□**Analog: Transmission by 3 core shielded cable**	
9	□ **Measurement control: 4mA to 20mA**	
10	□ **Sensor drifts below zero:**	
11	□ **Measuring range exceeded:**	
12	□ **Transmitter fault:**	
13	□ **Maintenance signal:**	
14	□ **Hart compatible:**	
15	■ **Site installation data: Hyderabad, Vijayawada & Kakinada Geographical Area**	
16	**Ambient temp.(ºC):** As indicated in CL 16	
17	**Relative Humidity (%):**As indicated in CL 16	
18	**Altitude (m):** As indicated in CL 16	
19	**Earth quake zone:** II, **Wind velocity (m/s):** As indicated in CL 16	
20	■Electrical area Hazard	
21	Class 1, Group D, Division1 as per NEC or Zone 1,Group IIA/IIB as per IS/IEC	
22	■ Applicable codes and standards	
23	■ Gas detection approvals: **CENELEC :Exd IIC 6**	**■ UL, CSA: Class 1, Div 1, Groups B,C,D**
24	**Voltage of supply**	
25	□ Operating voltage: A.C/D.C: V: Ph:	
26	□ In-Rush current: A.C/D.C	
27	□ Power input A.C/D.C	
28	■ **Physical specifications**	
29	□ Enclosure: **Nema 4+7 (IP65)**	
30	□ Size	
31	□ Weight	

32	■ Inspection and tests
33	□ Physical Tests on site:
34	Remarks

20.2 DATA SHEET- UV/IR FIRE DETECTION SYSTEM (IF NOT INDICATED SHALL BE FILLED BY THE BIDDER)

1	**GENERAL**			
2	**GENERAL: ■ Means required □ Means bidder shall indicate; if not indicated shall be Filled by the** bidder			
3	**PROJECT:** CITY GAS DISTRIBUTION NETWORK	SITE: **Hyderabad, Vijayawada & Kakinada**		
4	EQUIPMENT: **UV FIRE DETECTION FOR CNG STATIONS**			
5	**NO.**	FIRE DETECTION TYPE:		
6	NOTE: ■ SCOPE OPTION / INFORMATION SPECIFIED BY PURCHASER □ INFORMATION REQUIRED FROM VENDOR.			
7	□ MANUFACTURER:	□ MODEL NO.:		
8	□ **WAVE LENGTHS:**	■ **TYPICAL RESPONSE TIME: < 3 SEC @ 50FT**		
9	□ **FIELD OF VIEW:**	□ **MINIMUM SENSOR RESPONSE TIME:**		
10	□ **SENSITIVITY**	□ **MAINTENACE SIGNAL:**		
11	■ CLASSIFICATION: **CLASS I, DIV 1, GROUPS B, C & D: Eexd IIC, T5, IP66**	■ **CLASS II, GROUP E,F & G**CLASS III, TYPE 4X		
12	■ APPROVALS: CSA, FM, ATEX, CENELEC, CE MARKING			
13	■ **ENVIRONMENTAL SPECIFICATIONS**			
14	■ OPERATING TEMPERATURE RANGE: -40 (0C) **to** 85 (0C)			
15	■ STORAGE TEMPERATURE RANGE: -50 (0C) to 85 (0C)			
16	■ OPERATING HUMIDITY RANGE: 0% TO 100% RH NON-CON-DENSING			
17	■ ALTITUDE (M):			
18	■ EARTH QUAKE ZONE **V**			
19	■ INSTALLATION: ■ INDOOR			
	■ **ELECTRICAL SPECIFICATION:**			
20	■ INPUT POWER: 20 - 36 VDC, 24 VDC @ 150Ma max.		□ COPM FAULT	
21	■ANALOG SIGNAL: 4-20mA (600 Ohms Max.)		□ READY SIGNAL	
22	□ FAULT SIGNAL: 0Ma		□ UV SIGNAL:	
23	□ IR SIGNAL:		□ WARN SIGNAL:	
24	□ ALARM SIGNAL:		□ BAUD RATE:	
25	■ RELAY CONTACT RATING: 8A, 255VAC, 8A @ 24VDC		□ RS-485 OUTPUT:	
26	■ RFI/EMI PROTECTION: COMPLIES WITH EN50081- 2		□ STATUS INDICATOR:	
27	□ FAULT MONITORING:			
■ **MECHANICAL SPECIFICATION:**				
28	■ HOUSING:		■ LENGTH:	
29	■ **DIAMETER:**		■ **MOUNTING:**	
30	■ **CABLE ENTRY:**		■ **WEIGHT:**	
SCOPE OF SUPPLY				

31	■ **UV FIRE DETCTION SENSORS COMPLETE:**
32	■ **DATA SHEET COMPLETED**
33	REMARKS:

20.3 DATA SHEET OF CORIOLIS MASS FLOW METER (SUCTION)

Sl. No.	PARAMETER	REQUIREMENT
1.	Fluid	Compressed Natural Gas
2.	Measuring Principle	Coriolis Principle
3.	Operating Pressure	40 (max.) bars ,19 (Normal) bars, 8 (min.) bars (Will be confirm during detailed engineering.
4.	Molecular Weight	17 – 22
5.	Ambient Temperature	0 – 60 ^{O}C
6.	Hazardous area classification	Class I, Div I, Gas Group D as per NEC or Zone1,Group IIA/ IIB as per
7.	Range of operation	1100-1300 SCM/HR
		850-1000 KG/HR
8.	Accuracy	± 0.5% of span (over the whole operating range on gas)
9.	Rangeabiliy for specified accuracy (Min.)	50:1
10.	Line Size	2.0 " (Flange type), 300# WNRF (Material: 316 L)
11.	Pressure drop at max.	< 0.2 Kg/cm^{2}g
12	Repeatability	± 0.25% or better
13.	Material - Tube	SS 316 or Better
14.	End Connection	To suit the line size(2.0") , Flange connections
15	Power supply (nominal)	230±10% V, 50±2 Hz, 1 Φ
16	Outputs (Active)	
16.1.	4 – 20 mA dc	Reqd.
16.2.	Frequency	Reqd.
16.3.	RS 485	Reqd.
17	Outputs Information	
17.1	Mass Flow rate	Reqd.
17.2	Mass totalizer, non-resettable	Reqd.
17.3	Temperature	Reqd.
17.4	Integral Display	Display all outputs with specified accuracy, programmable and sequential with password protection, **Touch screen or touch keypad type**
18	Communication	**MODBUS with RS 485**
19	Mounting	Field mounting
20	Certification	Hazardous area compatibility, Weather proof certification i.e. IP 67, Material Test, Manufacturer's certification, Custody Transfer approval, AGA 11 Conformance certification and Calibration Certificate on water and Natural Gas from accredited test labs with traceability acceptable internationally.

20.4 DATA SHEET OF CORIOLIS MASS FLOW METER (DISCHARGE)

Sl. No.	PARAMETER	REQUIREMENT
1	Fluid	Compressed Natural Gas
2	Measuring Principle	Coriolis Principle
3	Operating Pressure	**300 (max.) bars ,255 (Normal) bars, 100 (min.) bars**
4	Molecular Weight	17 – 22
5	Ambient Temperature	0 – 60 ^{O}C
6.	Hazardous area classification	Class I, Div I, Gas Group D as per NEC or Zone1,Group IIA/ IIB as per IS/IEC specifications
7.	Range of operation	1100-1300 SCM/HR
		850-1100 KG/HR
8.	Accuracy	± 0.5% of span (over the whole operating range on gas)
9.	Rangeabiliy for specified accuracy (Min.)	50:1
10	Line Size	0.5 "(TUBE END)
11	Pressure drop at max. flow	< 0.2 Kg/cm^{2}g
1	Repeatability	± 0.25% or better
13	Material - Tube	SS 316 or Better
14	End Connection	To suit the line size (0.5") ,
1	Power supply (nominal)	230±10% V, 50±2 Hz, 1 Φ
1	Outputs (Active)	
16.1.	4 – 20 mA dc	Reqd.
16.2.	Frequency	Reqd.
16.3.	RS 485	Reqd.
1	Outputs Information	
17.1	Mass Flow rate	Reqd.
17.2	Mass totalizer, non-resettable	Reqd.
17.3	Temperature	Reqd.
17.4	Integral Display	Display all outputs with specified accuracy, programmable and sequential with password protection, Touch screen or touch keypad type
18	Communication	**MODBUS with RS485**
19	Mounting	Field mounting
20	Certification	Hazardous area compatibility, Weather proof certification i.e. IP -67, Material Test, Manufacturer's certification, Custody Transfer approval, AGA 11 Conformance certification and Calibration Certificate on water and Natural Gas from accredited test labs with traceability acceptable internationally.

20.5 DATA SHEET OF THERMAL MASS FLOW METER (TO MEASURE VENT LOSS)

SR. NO.	PARAMETER	REQUIREMENT

1	Fluid	Natural Gas
2	Measuring Principle	Thermal
3	Operating Pressure	50 mbar g
4	Molar Mass	17 -22
5	Ambient Temperature	0-60°C
6	Hazardous area classification	Class I, div I Gas Group D as per NEC or Zone 1, Group IIA / IIB as per IS / IEC Specification
7	Range of Operation	0.6 - 16 SCM/Hr
		0.5 - 12 Kg / Hr
8	Measured Error Mass	± 1.5% of indicated flow accepted (over the operating range of 2-12 Kg/Hr on gas)
9	Meter Size	0.5"
10	Pressure drop at max. flow	2 mbar max.
11	Repeatability	± 0.5% or better
12	Material Tube	SS 316 or better
13	End connection	To suit the line size, flange Connections
14	Power Supply (nominal)	230 ± 10% V, 45-65 Hz
15	Output (Active)	
16	RS 485	Required
17	Outputs Information	
17.1	Mass Flow Rate	Required
17.2	Mass Totalizer, non - resettable	Required
17.3	Temperature	Required over MODBUS
17.4	Integral Display	Display all outputs with specified accuracy, programmable and sequential with password protection. Touch Screen or Touch Keypad Type
17.5	Density	Required
17.6	Pressure	Required
17.7	Volume flow rate	Field configurable with password protection for molecular weight range: 17 to 22
17.8	Volume flow totalizer	Field configurable with password protection for molecular weight range: 17 to 22
17.9	Periodic mass & totalizer, non-resettable	Four (one each monthly, daily, fortnightly and one for configurable period)
18.	Programmer	Calibration software, perpetual licence with portable hardware platform complete with all connectors, power adopter, batteries. System should be suitable for effecting calibration changes, configuring the flow meter / transmitter, storing test result, plotting and storing graphs, diagnostics, password protection etc. Carrying case, easily installable in the field for calibration set up
19.	Communication	MODBUS with RS 485
20.	Mounting	Field mounting, (Vertical)
21.	Certification	CCOE/PESO

21.0 EXPERIENCE RECORD PROGRAMME OF GAS ENGINE DRIVEN COMPRESSOR (1200 / 600 SCMH)

Sl. No.	Description		INFORMATION OF OFFERED COMPRESSOR	INFORMATION OF EXISTING COMPRESSOR
1	REQUIREMENT AS PER TENDER			
	a) Status of bidder (manufacturer or **packager** and supplier of gas engine driven CNG compressor package)			
2	**COMPRESSOR**			
	Name of compressor manufacturer			
	Place of compressor manufacturer			
	Compressor model			
	Anticipated Life in running hours			
	Compressor maximum frame BKW			
	Compressor operating RPM			
	Compressor max design RPM			
	Comp Manufacturing code preferably API-618			
	Lubricated or non-lubricated			
	Nos of stages			
	Max stage temperature deg cen (150)			
	Compressor Operating RPM (max RPM-1500)			
	Piston speed (4.5 m/s lub, 4m/s non lub)			
	Compressor maximum vibrations at cylinders and at frame shall not exceed 10 mm /sec. And 5 mm/s respectively unfiltered peak velocity			
	Material for all stages			
	Cylinder			
	Piston Rings			
	Rider Rings			
	Piston Rod			
	Valve (Rings / Plates/ spring)			
3	**PERFORMANCE OF COMPRESSOR**			
CASE-L	Performance of compressor at 16 kg/cm2(g) suction pr, 255 kg/cm2 (g)discharge pr and 30 deg c suction temperature			
CASE-G	Performance of compressor at 17.5 kg/cm2(g) suction pr, 255 kg/cm2 (g)discharge pr and 30 deg c suction temp			
CASE-H	Performance of compressor at 19 kg/cm2(g) suction pr, 255 kg/cm2(g) discharge pr and 30 deg c suction temp			
	a) Capacity SCMH	**CASE-L**		
		CASE-G		
		CASE-H		
	b) BKW required by compressor including compressor's lube oil pump BKW	**CASE-L**		
		CASE-G		
		CASE-H		
	c) BKW required by compressor including	**CASE-L**		
		CASE-G		

	compressor's lube oil pump BKW **at RV set pr**	**CASE-H**		
	d) Power required for all heat exchanger fans including radiator fan of engine in Kw	**CASE-L**		
		CASE-G		
		CASE-H		
	e) Ventilation fans for enclosure No of fans Type of fans (induced or forced draft) Power required for all ventilation fans in Kw Capacity of gas engine (max of b+ max of d2 +e above) *1.1			
	Piston rod and cross head pin loading at any specified operating condition including the relief valve set condition shall not exceed 80% of the maximum design rod load of the offered compressor.			
	----Piston rod : max Design			
	----Piston rod : calculated at safety set pr condition			
	----Max cross head pin loading: Design			
	----Cross head pin loading :calculated at safety set pr condition			
4	**GAS ENGINE**			
	Make and model			
	Anticipated Life in running hours			
	Compression ratio			
	Power (ISO power) & corresponding Max RPM			
	Power (ISO) and corresponding Operating RPM			
	Site power (kW) at operating RPM after deration			
	KW of engine with availability of 10 % overload for one hour within a period of 12 hrs operation with no negative tolerance.			
5	**PACKAGE**			
	Name of packager			
	Place of packaging			
	Name of enclosure manufacturer			
	Place of enclosure manufacturing			
	Sound level at 1 m distance from package in db(A) - 70			
	Make & model LEL detector			
	Make & model fire detector			
	Co2 flooding system (2 cylinder each of 100% capacity required)			
	Quantity of CO2 in each cylinder in Kg			
	Volume of enclosure in m3			
	Min 3 Nos of explosion proof tube light			
	Coupling Direct/V-belt			
	Separators between inter stage of compressor			
6	**GAS INLET TRAIN**			
	WNRF, Flanged connection; outside canopy			
	Inlet relief valve			
	Inlet gas pressure gauge			
	Non return valve			
	Inlet filter of 5 micron size			
	Inlet twin filter			

	suction filter after main filter		
	Inlet manual isolation valve		
	Inlet automatic isolation valve		
7	**GAS RECOVERY SYSTEM**		
	Gas recovery system with pr relief valve, pr regulator, pr gauge, manual & automatic drainage system		
8	**GAS DELIVERY SYSTEM**		
	High pr piping with SS 316 tubing, compression fittings, NRV.		
	Coalescent final separator		
	Coalescent super fine filter with CE mark for removal of liquid (e.g. water & oil) and solid particles down to 0.1 microns out of compressed natural gas. Residual Oil Contents shall be less than 1 PPM.		
	Discharge isolation valve		
	PLC based Priority panel with SS 316 double ferrule compression fillings, tubing, full bore valve ball. Indicate nos of banks		
	Mass flow meter: Coriolis principle; interfaced with PLC; head mounted integral local display to indicate flow rate (Kg/hr), cumulative gas compressed (in Kgs) etc.; inbuilt totaliser non-volatile & non- resettable type ; suitable for hazardous area classification ; One at compressor discharge One at compressor inlet One for engine fuel gas		
	Final gas outlet connection from priority panel 3/4" (1" for bus) pipe OD SS double ferrule compression fittings.		
9	**ESD SYSTEM**		
10	**Volume bottles/ dampers at each compressor stage of compressor.**		
11	Drainage system :Manual isolation valve and automatic valves		
12	**Heat exchanger :** Code of construction API 661, Coolers stamped as per API-11P requirements.		
13	Piping between stages shall be continuous with flange and welded connection or SS316 L tubing with ferrule fittings.		
14	Instrument air tubing shall be SS 316		
15	Area classification; "Class 1, Group D, Division 1		
	as per NEC" OR "Zone 1, Group IIA /IIB as per IS/ IEC"		
	Instruments.		
	Engine		
16	The size of the complete package		
17	Beam for chain pulley block with Chain pulley block (indicate cap of chain pulley block)		
18	Acoustic and pulsation study		
19	Separate Acoustic enclosure for engine and compressor or only one.		
20	Instrumentation are as per tender.		

21	The offered compressors and gas engine and auxiliaries are new.		
22	Human-machine interfacing unit (HMI)		
23	String test at shop		
24	Field trial run at site		
25	Electric power requirement (purchaser will give electric power for air compressor, ventilation fans and compressor controls)		
	List out if any deviation w.r.t. tender.		
26	**Other information of existing compressor package :**		
	a) Year of manufacturing / packaging the compressor package		
	b) Name and address of user with FAX no, Phone no, E-mail address		
	c) Nos of hours the compressor have clocked on bid due date. (Enclose certificate from user)		
	d) Documentary evidence that the bidder/ manufacturer or packager having the capability and facilities (i.e. shop, manpower, testing facility etc.) for manufacturing / packaging compressor packages.		
	e) Whether the bidder having office set up in India equipped with trained and experienced technical manpower for the operation and maintenance services. If not submit the agreement of O&M company having experience of gas engine driven compressor package		

22.0 LIST OF INSTRUMENTATION & CONTROLS

22.1 List of min. Instrumentation & Controls to be provided for Compressor:

		INDICATION			ANNUNCIATION & PRE ALARM		TRIP	
Sl No.	**Description**	**GUAGE–LOCAL GUAGE BOARD**	**LOCAL GUAGE**	**INDICATOR LOCAL PANEL (PLC) DISPLAY**	**LOW LOCAL PANEL DISPLAY (PLC)**	**HIGL LOCAL PANEL-PLC- DISPLAY**	**LOW –LOCAL PANEL - PLC-DISPLAY**	**HIGH LOCAL PANEL PLC- DISPLAY**
1	Frame Oil Sump/Reservoir Level						■ yes, switch	
2	Main L/O Pump Disch. Pr (supply header).	■ yes		■ yes	■ yes		■ yes	
3	Oil Flow							
4	Oil Pressure at Main Bearing							
5	Supply Header Temp.							
6	Oil cooler Oil Inlet Temp.							
7	Stand by Pump Start							
8	Compressor Main bearing metal Temp.							
9	Cylinder & Packing Oil							
10	Lubricator Oil Level							
11	Lubricator Oil no Flow						■ yes	
12	Lubricator Failure							
13	Aux. Oil							
14	Lub. Oil Supply Pr.							
15	Lub. Oil return							
16	Elec. Motor bearing metal temp.							
17	Coolant System							
18	Each cylinder CW outlet temp.							
19	Inter/After/Oil Cooler CW outlet temp.							
20	CW Supply header flow							
21	Sight Flow CW return each cylinder, Cooler & Header							
22	For Closed Circuit Cooling							

23	Coolant main pump disch. Pr.			■ yes	■ yes			
24	Coolant standby pump disch. Pr.							
25	Coolant stand by pump start							
26	Coolant supply header Pr.							
27	Coolant supply header temp							
28	Coolant cooler Outlet Temp.	■ yes						
29	Coolant reservoir Level	■ yes			■ yes		■ yes	
30	Cylinder Coolant Outlet temp.							
31	For Static/Thermo-siphon System							
32	Cylinder Coolant Outlet temp.							
33	Diff. Pr. Across packing coolant filter							
	Process Gas System							
34	Temperature before twin filter & PRV at suction		■ yes					
35	Pressure before twin filter & PRV at suction		■ yes					
	Pressure before twin filter & PRV at suction*			■ yes	■ yes	■ yes	■ yes	■ yes
36	Each stage Outlet Pressure	■ yes		■ yes		■ yes		■ yes
37	Each stage Outlet temp.	■ yes		■ yes		■ yes		■ yes
38	After Cooler Gas Outlet temp.	■ yes		■ yes		■ yes		■ yes
	1st stage suction pressure low / high	■ yes		■yes	■yes	■yes	■yes	■yes
39	Cylinder Packing Vent Pressure							
40	Final Disch Press. after coalescent filter *	■ yes		■ yes	■ yes	■ yes	■ yes	■ yes
41	Blow Down vessel level							
42	Piston Rod Drop Indicator							
43	Distance piece diff. Purge pressure							
44	Common process parameters							
45	Common machine parameters							

46	Blow Down vessel Pressure							
47	Vibration Measurement on comp. heat exchanger							■ yes switch

* Pressure transmitter shall be of smart type with LCD display

22.2 LIST OF INSTRUMENTATION & CONTROLS FOR GAS ENGINE:

		INDICATION		ANNUNCIATION & PRE ALARM		TRIP & A/V ALARM ANNUN.	
SI No.	Description	GUAGE–LOCAL GUAGE BOARD	INDICATOR LOCAL PANEL (PLC) DISPLAY	LOW LOCAL PANEL DISPLAY (PLC)	HIGL LOCAL PANEL DISPLAY (PLC)	LOW –LOCAL PANEL -PLC-DISPLAY	HIGH LOCAL PANEL PLC-DISPLAY
1	ENGINE OIL LEVEL					■ yes, switch	
2	ENGINE OIL PR.	■ yes	■ yes	■ yes		■ yes	
	ENGINE OIL TEMP.	■ yes	■ yes		■ yes		■ yes
3	MAIN L/O PUMP DISCH. PR.						
4	LUB OIL FILTER DIFF. PR.						
5	L/O SUPPLY HEADER TEMP.						
6	OIL COOLER OIL OUTLET TEMP.	■ yes			■ yes		■ yes
7	STAND BY PUMP START						
8	**Differential pressure gauge for fuel and air mixture**						
9	OIL COOLER CW OUTLET TEMP.						
10	CW SUPPLY HEADER FLOW						
11	SIGHT FLOW CW RETURN EACH COOLER & HEADER						
12	Exhaust gas temperature from engine		■ yes		■ yes		

13	WATER LEVEL IN MAKE UP WATER TANK / RADIATOR	■ yes (only gauge)		■ yes			
14	ENGINE JACKET C.W SUPPLY TEMP.				■ yes		■ yes
15	ENGINE JACKET C.W RETURN TEMP. (INLET OF RADIATOR)				■ yes		■ yes
16	COOLANT MAIN PUMP DISCH. PR.	■ yes					
17	COOLANT SUPPLY HEADER PR.	■ yes					
18	COOLANT SUPPLY HEADER TEMP						
19	COOLANT COOLER OUTLET TEMP.	■ yes					
20	COOLANT RESERVOIR LEVEL					■ yes, switch	
21	**STARTING SYSTEM**						
22	AIR RECIEVER PRESSURE		■ yes	■ yes			
23	**INLET AIR SYSTEM**						
24	INLET AIR FILTER DIFFERENTIAL PRESSURE		■ yes				
25	BOOST AIR (TURBO CHARGER) DISCHARGE PRESSURE (IF REQUIRED						
26	CHARGE AIR COOLER OUTLET AIR TEMP. (IF REQUIRED)						
27	**MISCELLANEOUS**						
28	ENGIN E VIBRATIONS						
29	ENGINE/ MAIN motor speed						

30	START STOP BUTTON						
31	ENGINE SPEED					■ yes	■ yes
32	ENGINE /MAIN FAILS TO START						

33	FEUL GAS / ELECTRIC POWER CONSUMPTION INDICATION AND CUMMULATIVE		■ yes				
34	TACHO-HOUR METER	■ yes	■ yes				
35	Fuel gas pressure after PRV		■yes	■yes	■yes	■yes	■yes

23.0 QUALITY ASSURANCE PLAN AND CONTROL:

The supplier shall perform all test and inspection as per tender and as per this quality assurance plan.

CUSTOMER'S REF ..... : REF ..... ….. : COMPRESSOR MODEL ..... :

SI No.	Description	D	R	TW	W	
1.	**Compressor**					
	Material TC for: crank shaft, connecting rods, cylinder, piston	Yes	Yes	-	-	
	Hydro test of cylinder heads	Yes	Yes	-	-	
	Ultrasonic test of – crank shaft, connecting rod. piston rod. (refer note: 1) (MFR's compliance report/ certificate)	Yes	Yes	-	-	
	End clearance of the cylinders, piston rod run out	Yes	Yes	-	-	
	No load mechanical run test as per manufacturers standard (4 hours test at packager's end)	Yes	Yes	-		
	Strip check internal inspection after "NLMRT" of all compressors –Refer note: 2 at packager's end	Yes	Yes	-	-	
2.	**Engine**					
	Manufacturer test certificate	Yes	Yes			
3.	**Pressure vessels**					
	Dimension and Visual Inspection Report as per drawing	Yes	Yes			
	Material test certificates for RAW Material	Yes	Yes	-	-	
	Radiography of pressure vessels as applicable	Yes	Yes	-	-	
	Hydro test of pressure vessels	Yes	Yes	Yes	-	
	Final painting and cleaning	Yes	Yes	-	-	
4.	**Heat Exchangers (at sub-vendor works)**					

	WPS / PQR – Welder Qualification	Yes	Yes	-	-	
	Material test certificates for raw material (pressure parts)	Yes	Yes	-	-	
	Dimension and visual inspection report as per drawing / Data Sheet	Yes	Yes	Yes	-	
	Radiography of heat exchangers as applicable	Yes	Yes	-	-	
	Hydro test of heat exchangers : Note 3	Yes	Yes	Yes	-	
	Final painting and cleaning	Yes	Yes	-	-	
5.	**Discharge gas filter**					
	Manufacturer's test certificate	Yes	Yes			
	Final dimensions/Pneumatic test	Yes	Yes	Yes		
6.	**Control Panel**					
	Dimensions / visual as per drawing	Yes	Yes	-	Yes	
	Functional test	Yes	Yes	-	Yes	
7.	**Instrumentation**					
	Manufacturers test certificates/ calibration certificates of meas. Instruments for transmitters, gauges, switches & safety valve, filter, SS tubes, chain pulley block, acoustic material, CS pipe, fittings, flanges, fasteners, valves, CO_2 flooding system, PRV, air compressor, air dryer etc.	Yes	Yes	-	-	
	Manufacturer test certificates, testing & functioning of (PLC / HMI), MFM, Interlocking, Local Gauge Panel, Co2 flooding system, GD & LEL functioning	Yes	Yes	-	-	
	PLC/HMI	Yes	Yes	-	Yes	
8.	**Compressor package**			-	-	
	Surface preparation after cleaning & prior to primer painting, dimensions / visual as per drawing	Yes	Yes	-	-	
	Assembly check as per P&ID for each package	Yes	Yes	-	Yes	
	Mechanical run test and string test with Air/N2/natural gas	Yes	Yes	-	Yes	
	100% radiography of high pr. & low pr.	Yes	Yes			
	gas piping					
	Field trail run at site for each package for commissioning.	Yes	Yes	-	Yes	
	Package performance test at site at guaranteed parameters	Yes	Yes	-	Yes	

LEGENDS : D = Documents to be submitted by vendor / sub-vendor **; R =** Review of documents by Client/consultant**; TW =** witness by third party; **W =** Witness by client or consultant.	
NOTES:	
1	Crank Shaft, Connecting Rod: UT / MPT shall be conducted either in forged or in finished condition.
2	Strip test is limited to open Crank Case cover, X-Hd guide & Dist. Pc. Cover and opening of bore & other parts, Piston, one valve per cylinder.
3	Review of manufacturer's test reports/certificates of all parts
4	If bidder is only packager and not manufacturer of main CNG compressor the standard QAP of compressor OEM with test report of compressor and motor from manufacturer or as witnessed by TPE appointed by manufacturer shall be accepted

24.0 PREFERRED MAKES:

Preferred makes of equipment shall be as follows:

Sl. No.	Item description	Preferred Makes
1.	FLP motors	ABB / Compton Greaves / Kirloskar / Siemens / Bharat Bijlee/Weg/Marelli/LHP
2.	FLP Switchgear, FLP boxes, Cubicles	Baliga/ FCG/ FPE / Flexpro/M/s Sudhir
3.	Switches/fuses/contactors	L & T/ GEC/ Siemens/ Schneider
4.	Push Button	L & T/ Vaisno/ Technik
5.	MCCB	Siemens/ Legrand /Schneider
6.	Vibration switch	Robertshaw Control/ Murphy
7.	PLC	Rockwell Automation/ GE Fanuc/ Siemens/ Allen Bradley / L&T/Telemechnique/ Schneider
8.	IR Gas detectors	General Monitors / Crowcon / Honeywell / Sieger / Detronics/ Khrome Schroder / Net safety (Emerson) / Draeger / ESP safety Pvt. Ltd / M/s Oldham
9.	UV Flame detectors	General Monitors / Crowcon / Honeywell / Sieger/ Detronics / Khrome Schroder/ Net safety/ ESP safety Pvt. Ltd / M/s Oldham
10.	Mass Flow meter	Micromotion CNG 50 / E&H CNGmass DCI
11.	Pressure Transmitter	Druck/ Wika/ Honeywell/ ABB/Fisher/ Rosmount/ Yokogowa
12.	Pressure Regulator & Slam Shut Valve	M/s Pietro Fiorentini S.p.A. (Italy)/ M/s Emerson Process Management/ M/s RMG-Regel Messtechnik (Germany) / M/s Mokveld Valves BV (Netherlands)/ Tartarini / Fisher /M/s Gorter Controls (Netherlands) /M/s Dresser/ Nirmal /M/s Vanaz

13.	Pressure Safety Valve	M/s BHEL, OFE & OE Group (New Delhi)/ M/s Keystone Valves (India) Pvt. Ltd. Baroda/ M/s Sebim Sarasin Valves India (P) Ltd. (New Delhi/ Halol-Gujarat)/ M/s Tyco Sanmar Ltd. (New Delhi/ M/s Parcol SPA, Italy/ M/s Nuopignone, Italy/ M/s Sarasin, France/ M/s Tai Milano SPA, Italy/ M/s Fisher Rosemount (Now M/s Emerson Process) Singapore/ Mercer USA/ Fainger-Leser/ M/s Technical
14.	Pressure Gauges & Temperatures Gauges.	M/s AN Instruments Pvt. Ltd., New Delhi/M/s Altop/ M/s General Instruments Ltd., Mumbai (M/s GIC) / M/s WIKA / M/s Waaree (M/s Baumer)
15.	RTDs :	M/s General Instruments Ltd. Mumbai/ M/s Nagman Sensors (Pvt.) Ltd./ M/s Pyro Electric, Goa/ M/s Altop/M/s Wika
16.	SS Tubes for CNG application	M/s Sandvik, Sweden/ M/s Tubacex/M/s Ratnamani
17.	SS tube Fittings for CNG application	M/s Swagelok (USA)/ M/s Parker (USA /M/s SSP, USA/M/s Hylok/M/s Dk-Lok
18.	Plug/ball Valve for air/ water/low pressure gas	M/s Nordstrom Valves Inc. USA/ M/s Serck Audco Valves, UK/ M/s Breda Energia Sesto Industria Spa, Italy/ M/s Sumitomo Corporation, New Delhi/ M/s Fisher Xomox Sanmar India Ltd., New Delhi/ M/s Larsen & Toubro Ltd. (Audco India Limited), Chennai/M/s Microfinish/M/s Virgo/M/s BDK/M/s Petro valves
19.	Solenoid Valve	M/s ASCO / M/s Rotex / M/s Parker Hanifen/M/s Swagelok
20.	On Off SS ball/ needle/ non-return valve for CNG application	M/s Parker / M/s Swageloc/M/s SSP / M/s Dk-Lok for CNG application
21.	Cables and wires	INCAB/ Universal/ ASEAN/CCI/ FORT Gloster/ Finolex/ KEI/ Hylite/Polycable/Associated cables
22.	Barrier/ Isolators/Surge protector	MTL / Phoenix / P&F
23.	Air exchanger	GEI Hamon Ind Ltd/ GEA India / Patel Air temp/CP/KPCL
24.	SMPS	Telemecanique(Schnieider)/ Siemens/Phoenix
25.	Pressure switch	Orion/Switzer/Danfoss/Wika/IFM

Notes:

a. For procuring bought out items other than those listed above, the same may be acceptable subject to prior approval of Consultant/owner to the following: -

i. The vendor/ supplier of bought out item(s) is a regular and reputed manufacturer/ supplier of said item(s) for intended services and the sizes being offered is in their regular manufacturing/ supply range. Further,

the bidder has to certify that the item(s) has/have been regularly used by them in all the packages for the last two years and they are working satisfactorily.

ii. The vendor/ supplier should not be in the Holiday list of BGL / Any other PSU.

iii. The bidder should enclose documentary evidences i.e. PO copies, Inspection Certificate etc. for the above, along with their bids.

b. Some Items indicate only Indian Makes. Successful Foreign bidders may take prior approval of any other make also for which complete technical credentials (PO copies, Inspection Certificate etc.) of the proposed vendors shall have to be submitted for evaluation by Purchaser/Consultant.

25.0 CHECK LIST (for Scope of Supply for Reciprocating Gas Compressor Package)

Sr.No.	Description	Specified by purchaser (Yes/No)	Included by Bidder (Yes/No)	Remarks
1	**Each Reciprocating Compressor package complete with :**			
1.1	void			
1.2	Suction / discharge pulsation dampers /Volume bottles	**Yes**		
1.3	Process equipment such as separator complete with supports, drain system for separators	**Yes**		
1.4	Air cooled, lube oil, cooling water, inter-stage and discharge gas coolers with necessary air cooling arrangement	**Yes**		
1.5	Combined or separate closed circuit cooling water system for compressor (As required)	**Yes**		
1.6	Lubricating oil system for compressor	**Yes**		
1.7	Safety relief valves on each stage of the compressor.	**Yes**		
1.8	All interconnecting oil, gas, water, air piping within the compressor package	**Yes**		
1.9	All valves, tubing, fittings as specified and required within the compressor package	**Yes**		
1.10	Fuel supply hardware complete with SS piping, control valves, Regulators, Flow-meter, filter, vent/drain within the package suitable for the specified fuel gas	**Yes**		
1.13	Common skid for compressor and other auxiliary systems	**Yes**		

1.14	Acoustic enclosures for compressor for noise attenuation up to 70 dBA @ 1 m distance fitted with fire detection and extinguishing system as specified	**Yes**		
1.15	Instrumentation and control system complete with PLC based control panel, configuration as RTU of supervisory computer and data acquisition, instrumentation as specified.	**Yes**		
1.16	Cabling with cable trays for all the electrical devices within the package.	**Yes**		
1.17	Mass flow meter with integral display	**Yes**		
1.18	Inlet Pressure Regulators (Compressor Suction)	**Yes**		
1.19	Priority Panel (as specified) at Package Discharge	**Yes**		
1.20	Compressor gas inlet strainer, permanent twin inlet filter.	**Yes**		
1.21	Y-type strainers/paper filter, valves, sight flow indicators, check valves, auto drain traps as required for various compressor auxiliary systems, i.e. frame lubrication system, cylinder lubrication, cooling water systems etc.	**Yes**		
1.22	Manual package isolating valves and auto inlet isolation valve	**Yes**		
1.23	All couplings and guards	**Yes**		
1.24	Flywheels, barring device	**Yes**		
2	**Spares and Tools / Tackles**			
2.1	Mandatory Spares if specified in the TS ” (Indicate separate price for each item)	**Yes**		
2.2	Erection and commissioning spares as recommended by Bidder including lube oil consumables etc. as required for erection & commissioning of each compressor package.	**Yes**		
2.3	Operation and maintenance of each package for five years by the Bidder	**Yes**		

2.4	Four years normal operation and maintenance spares over and above the spares as required during one year warranty period of each package by the Bidder	**Yes**		
2.5	Quote for five years Normal operation & maintenance spares (excluding lube oil etc.)	**No**		
2.6	Special tools and tackles required for normal operation & maintenance of each equipment of compressor package as required and recommended by the Bidder	**Yes**		
3	**Inspection and Testing**			
3.1	As specified on the datasheets and tech. Spec.	**Yes**		
4	**Vendor data and drawings**			
4.1	All data & drawings as required per VDR format	**Yes**		
5	Erection, commissioning at site of the complete package	**Yes**		
6	Miscellaneous			
6.1	Foundation and anchor bolts	**Yes**		
6.3	Acoustical and mechanical analysis report & pulsation study (apporoach-3)	**No**		
6.4	Additional items not specified by Purchaser but recommended by Bidder for safe smooth and normal operation. (Bidder shall indicate separate list of such items in his proposal)	**Yes**		
6.5	Optional price quoted for complete compressor package with Non-flame proof electric panel in lieu of flame proof electric panel.	**No**		
6.6	Data sheet of compressor, gas engine motor, LEL and UV Detection system duly filled.	**Yes**		
6.7	Combined Speed-Torque Characteristic curve of gas engine and Compressor at rated inlet pressure.	**No**		
6.8	Electrical Load summary	**Yes**		
6.9	Catalogues of electric motor, flame proof equipments and Instrumentation	**Yes**		

6.10	Power required from UPS Supply (230 V AC Single Phase	**Yes**		
6.11	Power required from Non UPS Supply (415V TPN)	**Yes**		
7	Operation maintenance contract including all operating spares, consumables, manpower etc.	**Yes**		
7.1	It is recommended to use HP make lubricants for operation of compressor packages	**Yes**		

26.0 FORMAT OF DEVIATION TO THE TECHNICAL SPECIFICATION:

All deviations sought by the vendor shall be furnished in this format. If some deviations / observations / comments are furnished by the vendor at some other places of the offer, the same shall not be considered as deviation. Purchaser may accept some deviation in the interest of project. However, 1.5 times the cost of deviation shall be loaded in the offered cost for evaluation purpose.

SL. No.	Clause no.	Tender Specification	Deviation taken	Reasons for deviations / remarks

Certified that, only the above-mentioned deviations have been taken against this tender.

Name of the Bidder
Signature
Seal of the Company

TECHNICAL SPECIFICATION
FOR
ELECTRIC MOTOR DRIVEN COMPRESSORS
(1200 SCMH & 600 SCMH)

PREPARED AND ISSUED BY

LYONS ENGINEERING PVT. LTD.

NEW DELHI INDIA

CONTENTS

1.0 GENERAL

M/s Bhagyanagar Gas Limited, a joint venture of BGL (India) Limited, and HPCL is engaged in development of CNG (Compressed Natural Gas) as fuel to commercial & private vehicles through filling stations in the automobile sector & PNG (piped Natural Gas) to Industrial, household, commercial sector through City Gas Distribution Networks (CGDN) at different Geographical Areas in the country. PNGRB has awarded to BGL the work of development of City Gas Distribution Network for Hyderabad, Vijayawada & Kakinada Geographical Area. Presently, Bhagyanagar Gas Limited is planning to implement CNG & City Gas Distribution Network (CGDN) to supply Natural Gas to domestic, commercial, industrial and automobile consumers distributed over the Geographical Area (GA) of Hyderabad, Vijayawada & Kakinada Geographical Area.

1.1 SCOPE OF WORK

This specification along with applicable codes as referred, describe the minimum requirements for design, engineering, manufacturing, assembly, string testing, packaging, supply including forwarding, insurance, custom clearance, handling and unloading at port and delivery & unloading at BGL Gas store /site, re-transportation of the package from the store to the actual site/ station in Hyderabad, Vijayawada & Kakinada as applicable to the foreign and Indian bidders as per price schedule and special conditions of contract, , erection, testing, commissioning, Field performance test of Compressor Package including air compressor and auxiliaries at site, Five years O&M service (one year during warranty period and four years post warranty period) of the 1200 SCMH and 600 SCMH capacity ELECTRIC MOTOR DRIVEN CNG RECIPROCATING GAS COMPRESSOR PACKAGES for suction pressure of 16 kg/cm^2(g) [performance pressure range of 16 to 19 kg/cm^2(g)] with discharge pr. 255 kg/cm^2(g) as required for dispensing CNG to vehicles at various locations in Hyderabad, Vijayawada & Kakinada Geographical Area. Various parts of this specification shall be read in conjunction with each other and in case where the different parts of this specification differ the more stringent requirement shall govern.

Any additional work/equipment or technical requirement not mentioned in the specification but required to make the offered system complete in accordance with the specification and for safe and proper operation, shall be deemed to be included in the scope of work by the Bidder.

The quantities of electric motor driven compressors required shall be as per SOR (Schedule of Rates) cited elsewhere in the tender document.

Delivery Time Schedule of Electric Motor Driven CNG Compressors shall be as follows:

Group No.	Capacity of Compressors	Qty.	Time Period
Group B.1	1200 SCMH Motor Driven CNG Compressor Package	Total – 6 Nos	Two nos. of compressors shall be delivered in 3 months from FOA. For remaining quantities will be delivered after intimation by EIC within delivery schedule.
Group B.2	600 SCMH Motor Driven CNG Compressor Package	Total – 7 Nos	Three nos. of compressors shall be delivered in 3 months from FOA. For remaining quantities will be delivered after intimation by EIC within delivery schedule.

1.2 CODES & STANDARDS

The design, construction, manufacture, supply, testing and other general requirements of the compressor package equipment shall be strictly in accordance with the data sheets, applicable API codes, and shall comply fully with relevant National/ International standards, Indian Electricity Act, Indian Electricity Rules, regulations of Insurance Association of India and Factories Act while carrying out work as per this specification.

Any modification suggested by the statutory bodies either during drawing approval or during inspection, if any, shall be carried out by the Bidder without any additional cost and delivery implications.

The following codes and standards (versions/ revisions valid on the date of order) are referenced to & made part of specification:

API-11P/ISO 13631-2002: Petroleum and natural gas industries packaged reciprocating gas compressors

PNGRB regulations

OISD 179 -2016: Safety requirements on compression, storage, handling, refuelling natural gas (CNG) for use in Automotive sector.

ASME B 31.3 -2016: Process piping

NFPA-37-2015: Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines

NFPA-52- 2016: Vehicular natural gas fuel systems code

NFPA-496-2017: Standard for purged and pressurized enclosures for electrical equipment.

NFPA-68 -2013: Standard on explosion protection by deflagration venting.

NFPA-70 -2017: National electrical code

NFPA 12-2015: Standard on Carbon dioxide Extinguishing system

ASME Sec IX: Qualification Standard for Welding and Brazing Procedures, Welders, Brazers, and Welding and Brazing Operators

Gas Cylinder rules-2016

ANSI, ASTM, NEC, NEMA, Indian Electricity Rules, Indian Explosives Act.

1.3 PRECEDENCE

In case of any conflict among the various documents of this requisition the following preferential order shall govern:

i. Data sheets/drawings
ii. This Technical Specification
iii. Indian Standards / codes applicable

iv. International standards/codes as applicable

Compliance with this specification shall not relieve the Bidder of the responsibility of furnishing equipment and accessories of proper design, material and workmanship to meet the specified operating conditions.

No deviations to the technical requirements and to the scope of supply specified in this enquiry document shall normally be accepted and offers not in compliance to the same shall be rejected summarily. In case a deviation is required due to inherent design of the equipment offered, the Bidder shall list all such deviations at one place giving reasons thereon.

1.4 SCOPE OF SERVICES

i. Engineering, design and manufacturing.
ii. Procurement of raw materials etc., from sub-vendors.
iii. Preparation of documentation for design, approval by Purchaser / consultant.
iv. Inspection and testing as per T.S.
v. Surface preparation, protective coating and painting as per T.S. vi. Packaging for transportation to site and supply.
vii. Erection, testing & commissioning as per T.S.
viii. Performance test at site.
ix. Post commissioning annual maintenance with all spares and consumables.

1.5 SCOPE OF SUPPLY FOR EACH COMPRESSOR PACKAGE

Each compressor Package shall be completed with:

i . Lubricated or non-lubricated two throw balanced opposed reciprocating compressor / trunk piston design compressor block / Hydraulic compressor with lube oil system and cooling system (console type) as required.

ii. Electric Motor as compressor driver.

iii. Gas meter (2 nos.): Endress & Hauser make or Mass flow meter (Model CNG 50 with integral local display) based on Coriolis principle of Micro motion, USA with F-series 2700 transmitter at compressor discharge, F-series with 1700 transmitter at compressor suction. Installation and manufacturing of mass flow meter shall be as per as per AGA-11.While installing special care shall be taken to isolate the mass flow meter from piping vibration. Mass flow meter (Model CNG mass DCI with integral local display) based on Coriolis principle shall be considered. The mass flow meter shall be W&M approved only.

iv. Electrical equipment / Instruments indicated in the Compressor package.

v. Cable & software to connect client laptop to PLC to view the data online/offline, analyse the data online/offline, change the programming if desired.

v. Separate flameproof junction boxes for different type of signals like analog, digital signals, alarm, shutdowns, and thermocouples, RTDs etc. for interfacing to FLP local panel if required. Same is not applicable for direct run cable up to PLC panel.

vi. All cables and accessories shall be as per cl. No. 7.0.

vii. Common structural steel skid for the compressor - electric motor and for all auxiliary systems. Auxiliary systems such as Air compressor, Air receiver, CO2 flooding system,

Filters, associated piping, valves, flanges, stud bolts, nuts and supports can be supplied as loose items and shall be assembled by the bidder at site.

viii. Structural supports within the compressor package for all piping, electrical and instruments etc.

ix. Inlet twin suction gas filter of filtration level up to 5 micron with oil drain valve & DP gauge and suction line strainer at 1st stage and at other stage if required. A basket strainer of filtration level up to 5 micron with oil drain valve & DP gauge shall also be installed in the inlet pipe after the isolation valve to be installed by the contractor at the battery limit.

x. Inter-stage and discharge gas, air cooled heat exchanger.

xi. Separator/ Knockout drums/volume bottles with solenoid valve operated drains as required. Bypass valves for automatic drain system shall be as per manufacturer's recommendation.

xii. Priority Panel at Package Discharge as per Priority fill system in cl. 5.5.

xiii. All interconnecting oil, gas, water, air piping within the compressor package. xiv. All stud bolts and nuts shall be hot dipped galvanized as per ASTM A 153 or equivalent.

xv. Impulse and pneumatic piping/Tubing for all valves, fittings as specified & required for mounting the instruments.

xvi. NRV at gas suction, final discharge point and priority panel as required.

xvii. Y- type strainers / paper filter, valves, sight flow indicators , check valves, manual drain / traps etc. as required for various auxiliary systems i.e. frame lube oil, cylinder lubrication system, cooling water systems, fuel supply/conditioning system etc.

xviii. Coupling / V-belt / pulleys.

xix. Single Acoustic enclosure for both Compressor and electric motor as specified, with two number L.E.L detectors and two UV / IR detectors in enclosure.

xx. CO_2 extinguishing system consisting of twin cylinders, piping and valves.

xxi. Inlet and outlet manual & automatic isolating valves.

xxii. Piping from air compressor and CO_2 cylinders up to enclosures at a max. distance of 30m each is in the scope of bidder and shall be treated as part of supply & erection.

xxiii. Structural supports required for fixing of piping, ESDs & PVC clamps for SS tubes are also included and to be erected at site during installation of the package. Anchor fasteners for air receiver, air compressor, air dryer, CO_2 flooding system, ESD are also included and to be erected at site during installation of the package.

xxiv. Complete Erection, Testing & Commissioning of compressor packages.

xxv. 05 nos. of ESDs (One no. on LCP of compressor, One no. on soft starter panel, One no. in control room, One no. in process area, One no. near dispenser).

xxvi. Comprehensive Annual O&M for five (05) years (one year during warranty period and four years post warranty period) with spares, consumables, man power and lubricants.

xxvii. The provision for overhead mounting of cascade [3000 water liter capacity with approximate weight of 6.5 tons] should be there & same should be of enough strength having working space and with ladder arrangement. However Cascade supply and its Mounting on the structure shall be in the scope of purchaser. Structure Stability compliance Certificate of the unit from the manufacturer where cascade will be mounted to be

submitted during detail engineering. Cascade drawing will be provided during detailed engineering. However if any modification is required for the structural frame of the compressor on which cascade is to be mounted is to be carried out at site by the bidder during installation of the cascade by the owner.

xxviii. Priority panel shall be kept outside in a separate enclosure or mounted on compressor walls externally. Priority panel shall be of seven bank and pneumatic actuated type and consisting of inlet and outlet valves, non-return valves, safety valves, pressure transmitters in each line. All unused priority outlets to be plugged with dummy plugs after isolation valve.

xxix. Priority Panel shall be fully operated through PLC (Pneumatic Actuated Valves).

xxx. Copper Armored cable (FRLS) from starter to motor is in compressor's bidder scope.

xxxi. Temperature element shall be of insertion type.

xxxii. Load Torque Graph and the speed torque graph to be provided for electrical motor.

xxxiii. Power Consumption Vs. Suction Pressure Graph to be submitted by bidder along with Technical Bid.

xxxiv. Each stage outlet Temp. before cooler & after cooler to be displayed on PLC. xxxv.

CCOE / BIS approvals of cylinders used in CO2 flooding system to be submitted.

xxxvi. Gas flow directions to be marked "Gas In / Gas out "with cylinder stage No. on all the inlet outlet tubes inside compressor package.

xxxvii. Priority panel outlet connection shall be terminated through ¾ '' OD full flow ball valves with ¾'' Tube OD end connections. Bus cascade and bus dispenser lines shall be terminated through ¾ '' OD full flow ball valves with ¾'' x 1" expander to connect 1" tube.

xxxviii. The motor to be selected should be for continuous duty operation.

xxxix. Bidder shall furnish a basket strainer fitted with adequate size mesh at the gas inlet before duplex filter. The free area of the strainer element shall be at least four (4) times the internal area of the connecting pipe lines. Flow area in any portion of Basket strainer assembly shall not be less than the pipe cross sectional area. The strainer element shall be with the mesh of 5 micron. Pressure drop in clean condition shall not be more than 4.0 MWC. Wire mesh of the strainers shall be suitably reinforced, to avoid buckling under operation. Strainer shall have screwed blow off connection fitted with a removable plug. The strainer will have a permanent stainless steel tag fixed on the strainer body indicating the strainer tag number and service and other salient data. The size of the strainer and the flow direction will be indicated on the strainer body casting. Thickness of the strainer element should be designed to withstand the pressure developed within the strainer due to 100% clogged condition exerting shut-off pressure on the element.

xl. Vendor to provide 1 set of NO/NC contact (NO/NC Rating: 230 V AC, 5A). This contact shall changeover whenever ESD switch is activated.

xli. Power Meter has to be provided. (required for monitoring Voltage, Current etc of compressor in PLC panel).

xlii. All gas piping downstream of coalescent filter in compressor discharge shall be of SS 316 only.

xliii. The pressure in each bank should be monitored downstream of priority panel with the help of PLC by providing PT in each bank in priority panel

xliv. Copper jumpers for all the flange joints of field gas piping outside the compressor package.

xlv. Pre alarm to be incorporated in the software before machine trips in predefined values of Pressure & temperatures.

xlvi. To cater to the normal power supply requirement :-

a) One number of 415 Volt (+/-10 %) 3-phases 4 Wire, 50 Hz (+/-5%) shall be provided by Owner in PDB for the incomer of soft starter panel.

b) One number of 415 V (+/- 10%), 3 Phase 4 Wire, 50 Hz (+/-5%) shall be provided by Owner in PDB for Air Compressor

c) One number of 240 V (+/- 10%), 1 Phase, 50 Hz (+/-5%) shall be provided by Owner in LDB for Air Dryer.

Bidder shall indicate power / Feeder (KW / Amp) requirement in the offer. Supply, Laying & termination of the cable from the outgoing terminal of PDB/LDB and further distribution is in the scope of bidder.

xlvii. To cater to the UPS power requirement of the compressor for PLC based control panel, one number of UPS (240 +/-1 % V, 50 +/-1 % Hz) (feeder in UPS ACDB) shall be provided by Owner. Supply, Laying & termination of Incoming cable from ACDB to Compressor and further downward distribution is in the scope of the Bidder. Bidder shall indicate power / feeder (KW / Amp) requirement in the offer. Surge protection devices of approved make shall be provided in the control panel.

xlviii. Supply, Laying and Termination of following cables including all erection accessories like Lugs, Glands etc is included in the scope of Bidder:-

a) Cables from PDB to compressor skid (Length shall be considered as 100 meter).

b) Cables from compressor to hooter and up to ESD push button in control room (Length shall be considered as 75 meter).

c) Cables from compressor / ESD (Loop) to ESD push button near dispenser (Length shall be considered as 200 meter).

d) Cables from compressor / ESD (Loop) to ESD push button in field (Length shall be considered as 150 meter).

e) Cables from PDB to Air compressor (Length shall be considered as 50 meter).

f) Cables from LDB to Air Dryer (Length shall be considered as 50 meter). g) Cables from CO_2 flooding system to Compressor (Length shall be considered as 30 meter).

h) Cables from ACDB to compressor skid for PLC based control panel (Length shall be considered as 100 meter).

i) Cables from manual switch/call point of CO_2 flooding system (located in control room) to compressor skid. (Length shall be considered as 75 meter).

Suitable arrangement like cable trays, conduits etc shall be used for laying the cable.

xlix. One number of dedicated Electronic earth pit shall be provided for the PLC based control panel of compressor at a distance of 5 meters form the compressor by Owner. However cabling from the pit to the PLC based control panel and further distribution is in the scope of Bidder. For earthing of the body of the Gas compressor, Air Compressor, Dryer and other components, an earth grid will be provided at a distance of 5 meter from the compressor package. Cabling from the grid to the Gas Compressor, Air Compressor & Air Dryer shall be done through GI strip of 25X3 mm/cable of 1Cx10 sq.mm, Copper conductor whereas for panel it shall be done using Cu Strip of 25x3 mm / cable of 1Cx10 sq.mm, Copper conductor including all accessories like lugs, glands etc is included in the scope of Bidder.

xlx. Training of 4 persons (2 supervisors + 2 operators) at packager's workshop.
The traveling boarding and lodging of Purchaser's engineers shall be borne by PURCHASER. Training module shall span for one week and shall cover the equipment constructional features, operational and maintenance procedures etc.

xlxi. Vendor has to provide dedicated Mobile phone & number for each site/compressor. BGL shall not pay any extra charges towards phone & monthly bills.

Any conflict between the above scope / specification / requirements, most stringent will be followed as per the instruction of EIC.

xlxii. Bidder shall supply Two nos. Flow Meter along with Electric Motor Driven Compressor package.

xlxiii. Bidder shall supply UPS System of required capacity for smooth operation of Compressors considering the load of two nos. Dispenser.

xlxiv. Bidder shall supply Safety Signage and Warning Signage with the packages.

xlxv. Bidder shall consider PCV at inlet line (at Suction) with a range of 0-49 kg/cm^2(g) and outlet pressure of 16-19 kg/cm^2(g) and Filter Skid etc.

xlxvi. Bidder shall handover BGL – One set of special tools like manometer, timing light, UV torch, temperature gun, tachometer, filler gauge and any other special tools and tackles (not mentioned above) after warranty period.

xlxvii. Bidder shall have to maintain the DB level as required by the respective state PCB Norms.

xlxviii. Bidder shall consider soft starter for Motor Driven Compressors.

xlxix. Bidder to provide proper training for safe & smooth operation and maintenance of Compressor packages.

xlxx. Bidder shall provide:

- 9-line Priority Panel at Package Discharge as per Priority fill system for 1200 SCMH Gas Engine driven compressors.
- 7-line Priority Panel at Package Discharge as per Priority fill system for 600 SCMH Gas Engine driven compressors

Note:
Any conflict between the above scope / specification / requirements, most stringent will be followed as per the instruction of EIC.

1.6 **EXCLUSIONS**

The following are excluded from the scope of the Bidder:

i. All civil works and foundation design. However the Bidder shall furnish all the relevant data for design of pedestal / foundation. Grouting of equipment on the foundation including supply of material with foundation bolts (if required for bidder's design) is a part of erection and is included in the scope of bidder's work.

ii. CNG storage cascade.

iii. Piping between priority panel to cascade/dispenser.

iv. LCV fill trailer panel (For 600 SCMH Compressors only).

1.7 **Safety**

1.7.1 All controls shall operate in a fail-safe mode i.e. failure of any control shall not lead to running of equipment in unsafe mode. Fail safe control shall be available through both software and hardware for all trips.

1.7.2 **Area Classification :** The hazardous area classification Class-I, Division I, Group D as per NEC or Zone I, Group II A/ II B as per IS/ IEC. Certificate from recognized agency to the effect that equipment supplied and/or installed conform to above area classification. All Devices shall meet the requirement for the specified area classification in which they are installed, including instrumentation leads.

1.7.3 All exposed rotating parts shall be provided with adequate guards of non-sparking type.

1.7.4 Drive belt if used shall be of fire retardant and anti-static type.

1.7.5 Piping shall be arranged in a manner so as to provide clear headroom and accessibility within the package. Adequate clearances shall be provided for all the engineered components for O&M point of view.

1.7.6 Package enclosures shall have two IR type L.E.L detectors and two Ultra Violet (UV)/IR fire detectors in each enclosure to cover the enclosures effectively.

1.7.7 All material used in the package shall be flame retardant.

1.7.8 Relief Valves shall be provided at suction and discharge and in between inter stages of compressor with setting as per cl. 11.18.5 of ISO 13631:2002 with R.V. venting as per cl. 11.18.6 of ISO 13631:2002. All vents to be jointed to common relief valve header.

1.7.9 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) with self- check function (have self-diagnostic LED to show the "HEALTHY" and "FAULTY" status) 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. Necessary calculation shall be submitted by the bidder during detailed engineering. 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, 2016. Cylinders shall be fitted with actuated Valves, Solenoid valves, limit switches, pressure switch etc. for automatic actuation.

Control philosophy shall be such that:

a. Compressor shall trip on detection of gas at preset level.

b. Compressor shall trip on detection of flame at preset level and automatic discharge of CO2 gas shall take place simultaneously.

c. On detection of flame by any of the flame detector, the solenoid valve of selected cylinder will open and CO2 will be flooded into the package.

d. At that time, pressure switch will open (NO) because of pressure in CO2 header. If the selected cylinder is empty, then pressure switch will operate (NC) and PLC will give signal to open solenoid valve of other cylinder, if flame is detected by flame detector.

e. Even after discharge of selected cylinder, If flame remains detected by flame detector, other cylinder can also be operated after 20 sec (Settable from display) from the time of selected cylinder valve energized irrespective of pressure switch signal.

f. The limit switch provided on the weighing machine will be connected to PLC to indicate that the CO2 cylinders are full. Both are start permissive for compressor. i.e. if any of the cylinders is empty as sensed by limit switch, compressor will not start. If the operator wants to run the package even if one of the cylinders is empty, the compressor can be run by putting Limit Switch in BYPASS mode for obtaining start permissive.

g. When maintenance override switch put in BYPASS mode to keep the system off during maintenance, CO2 Solenoid valve shouldn't operate, even on detection of flame by any of the flame detector

iv. Facility shall be made to operate the system manually from remote with the help of a switch/ call point and with help of pull down lever on cylinders. In this regard, manual switch / call point shall be provided to operate the desired (Main / Standby) CO2 cylinder remotely from control room and Pull down lever shall be provided on each cylinder valve for manual operation.

v. Following Selector switches shall be provided :

a) One Selector switch shall be provided in LCP to put Main/Stand by

Cylinder in line at the turn of a switch as per requirement.

b) One maintenance override switch shall be provided in LCP to keep the system off during maintenance.

c) One switch shall be provided in LCP to bypass desired limit switch, d) One switch in control room to operate CO2 remotely

vi. The System shall be designed to operate on 24 V DC supply. FRLS (Fire resistant low smoke) cables shall be used for the wiring of the system.

vii. CO2 Cylinders shall be provided with explosion-proof fittings.

viii. Online weight (CO2) loss indication device to be provided to ascertain the health of the CO2 flooding system.

ix. All installation and instruments shall be compatible for hazardous area Class 1, Division 1, Group-D for Methane Gas.

x. Technical specifications, Operation and Maintenance Manual, CCOE Certificate i.e Approval/ Manufacturing certificates for cylinders and cylinder valves, gas detectors, flame detectors, solenoid valves etc. shall be furnished by the supplier along with system. Software and hardware, calibration procedure shall be provided by the supplier along with the supply sufficient enough to handle the system independently.

xi. System shall be tested by the supplier after commissioning at site by creating fire signal and actual discharge of CO2 Gas from the Cylinders. The cylinders have to be refilled by the vendor at no extra cost to purchaser after testing. If the system fails during testing, subsequent testing and refilling would be at vendor's cost.

xii. Warning and Operating instructions to be displayed at equipment as per the statutory/ safety regulations.

xiii. Health status of CO2 system shall be monitored & controlled through PLC.

2.0 UTILITIES & BATTERY LIMITS

2.1 Utilities

2.1.1 Bidder shall make his own provision for Instrument air with a flame proof electric motor driven air compressor, receiver and air dryer system.

2.1.2 Air compressor with discharge pressure of 7 kg/cm^2 (g) suitable for 1.5 KW electric motor rating or higher with dryer shall be supplied by bidder. Compressor to be supplied should be preferably of IR / KPCL / ELGI / CP make and air receiver of 500 water liter capacities shall be provided. Air dryer suitable for automatic operation shall also be supplied along with all accessories. The air compressor motor shall be flameproof and will be kept in CNG area. Piping,
electrical & instrumentation cabling shall be in bidder's scope. Necessary FR unit shall be provided as per requirement. Manual drains and automatic moisture traps / moisture separator cum regulator shall be provided in the system. Air receiver shall be provided with SRV, pressure gauge and drains with isolation valves. Air dryer shall be with bypass arrangement.

2.1.3 Tapping from air receiver / dryer shall be provided as follows;

a. For dispenser: One ½" tapping with isolation valve from all air receivers.

2.1.4 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. However cooling water for make-up tank is available.

2.1.5 All electrical and instrumentation terminals shall be as specified.

2.1.6 Electric power shall be made available by Owner as described in scope of supply.

2.2 Battery limits

2.2.1 Gas Inlet shall be brought out to a distance of 10m from the package edge and terminated in nozzles with isolation valves having flange connection. The piping along with structural supports, copper jumpers for all the flange joints from battery limit to Compressor package shall be in bidder's scope. Piping from air compressor to air receiver and CO2 cylinders up to enclosures at a max. distance of 30m each is in the scope of bidder and shall be treated as part of supply & erection. All the SS tubing shall be supported properly with PVC clamps only. All the drain pipes of air compressor, air receiver, air dryer shall be terminated to the nearest drain properly.

2.2.2 As and where specified on the data sheets all vents (i.e. Relief valve, distance piece and packing) shall be manifold and terminated at skid edge outside the enclosure and vented to safe height of 3.0 m at package roof.

2.2.3 All drains from different process equipment, distance piece and packing (if applicable for bidder's design) shall be manifolded and terminated at single point for customer interface duly flanged with isolation valve.

2.2.4 The Bidder work shall commence from Outgoing terminals of PDB/ACDB/LDB (PDB/ACDB/LDB is in the scope of Owner). Downstream distribution arrangement from the PDB to the Online Compressor is in the scope of Bidder.

2.2.5 The Bidder work shall commence from the cabling from electronic earth pit & earthing main grid at a distance of 5 meter from the compressor package. Downstream distribution is in the scope of Bidder.

3.0 EQUIPMENT QUALIFICATION CRITERIA

3.1 **Gas Compressor**

At least 1(ONE) gas compressor of 600 SCMH or higher capacity of offered model, with minimum discharge pressure of 255 kq/cm2 Supplied by the bidder, should have completed minimum 8000 running hrs as on the bid due date.

4.0 BASIC DESIGN

4.1 General

4.1.1 The Compressor shall meet all the technical requirements as specified in:

i. Data sheets : As enclosed

ii. Technical Specification:

iii. Code and specification as indicated in clause no.1.2

iv. Compressor and its auxiliary's design shall be in conformity with ISO 13631:2002 / API 11P

4.1.2 Gas composition given under Design Case shall be used for Compressor selection, sizing and performance guarantee estimates. However compressor shall be suitable for continuous operation with the indicated gas composition range and operating parameters given in this tender.

4.1.3 Suction line pressure may vary from 16 kg/cm²G to 19 kg/cm²G with discharge pressure at 255 kg/cm²G. A suction pressure regulator shall be installed to limit the suction pressure to 19 kg/cm²G. The suction pressure of 16 kg/cm²G shall be used for compressor sizing/ selection.

4.1.4 Bidder's offer shall be based on firm and final compressor / electric motor models on which basis the offer shall be evaluated and no alternate compressor / electric motor models or change of models to lower frame shall be entertained.

4.1.5 Note that the pressures given on the data sheet are at the compressor package battery limits, Bidder shall consider all pressure losses at suction, inter-stage and discharge at the specified capacity (with no -ve tolerance) for compressor and indicate the same on the data sheets.

4.1.6 Bidder to consider the compressor package with low power consumption range/kg production.

4.1.7 Closed loop compressor packages to avoid gas loss / venting into atmosphere.

4.2 Allowable speeds, temperature and vibration levels

4.2.1 The linear piston speed shall be limited to 4 m/sec for non-lubricated and 4.5 m/sec for lubricated compressors.

4.2.2 The maximum discharge gas temperature for each stage shall be limited to 150^{o}C.

4.2.3 Compressor maximum vibrations at cylinders and at frame shall not exceed 10 mm/sec and 5 mm/s respectively at unfiltered peak velocity. The Bidder shall provide structural support within the package so that these levels can be achieved.

4.3 Piston Rod, Bearings and Cross Heads

4.3.1 The surface hardness of Rockwell C 50 minimum is required on piston rods in the areas that pass through the packing. Rolled threads shall be provided on the rods with thread relief area as polished.

4.3.2 Crosshead shall be manufacturer standard material and designs. Adequate openings for removal of the crossheads shall be provided.

4.3.3 Piston rod and cross head pin loading at any specified operating condition at the relief valve set pressure shall not exceed 80% of the maximum design rod load of the offered compressor. Rod loads shall have sufficient reversals in direction for all specified operating conditions including RV Settings and part load operation.

4.3.4 Frame rating as published in catalogues of the offered compressor model shall be min 1.1 times

the required rating corresponding to max severe operating conditions taking into account temperature correction factor.

4.4 Packing Cases and Pressure Packing

4.4.1 All oil wiper, intermediate gas cylinder pressure packing shall be segmental rings with stainless steel garter springs. The pressure packing case shall be provided with a common vent and drain below the piston rod tube to the outside of the Package enclosure. However if pressurised crankcase type design is used, packing vent and drain shall not be provided.

4.4.2 Packing vent piping inside of the distance piece shall be designed for the maximum allowable working pressure of the cylinder.

4.5 Compressor Crankcase Lubrication

4.5.1 The crankcase lubrication shall be pressurized system, with a main oil pump driven directly by the compressor shaft.

4.5.2 If required the Bidder shall provide manually operated/ air/electric motor driven pre lubrication pump. Crankcase shall be fitted with lube oil temp & oil level indicator. The maximum and minimum operating levels shall be permanently indicated.

4.5.3 Heating shall be provided for reservoir if applicable for the bidder's design of compressor when the minimum ambient temperature is less than the Bidder's required minimum start up temperature.

4.5.4 Heater besides meeting the area classification requirements specified in the Tender shall be star connected if designed for operation on 3-phase (4 wire), 440V, 50 Hz supply.

4.6 Distance Pieces

4.6.1 Distance piece as per ISO 13631-2002 with cylinder side compartment vented to safe location is specified. Distance piece as per manufacturer's standard design which is used in the earlier supplied successfully running packages is also accepted.

4.6.2 Distance pieces shall be provided with casketed, solid covers and shall be suitable for a minimum differential compartment pressure of 1.75 kg/cm²g.

4.7 Cylinder and Packing Lubrication

4.7.1 Divider block type lubrication system / Single plunger per point force feed mechanical lubricator shall be provided for lubrication to compressor cylinders. Block-distribution lubrication systems shall be complete with no-flow shutdown, rupture relief discs, check valves, filter, common sight glass and carbon steel or austenitic stainless steel tubing. For pump-to-point lubrication systems, a sight indicator for each point, check valves and carbon steel or austenitic stainless steel tubing shall be furnished.

4.7.2 Lubricators shall be driven by crankshaft and bidder shall highlight any pre lubrication requirements of the cylinders and the method of achieving the same.

4.7.3 For pump-to-point lubrication systems, Lubricators shall have a sight flow indicator for each lubricator point and a stainless steel double ball check valve shall be provided at each lubrication point.

4.7.4 Digital no flow timer shall be provided to stop the compressor in case of loss of cylinder lubrication.

4.7.5 Lubricator reservoir capacity shall be adequate for 100 Hrs of normal flow, and shall be equipped with low level alarm.

4.7.6 Bidder along with the proposal shall furnish the recommended lubricating oil type, International Grades & Specification (HP make Lubricants mandatory) along with their quantity and frequency of change. The recommended oil shall be compatible with gaskets, O-rings, seals, packing, lubricator parts and other parts coming into contact.

4.8 Cooling System

4.8.1 Compressor Cylinder

Compressor cylinders must be air-cooled only. Water cooled cylinders are not acceptable.

4.8.2 Inter / After Gas Coolers

Air-cooled inter-stage and final stage discharge coolers shall be provided which shall limit the gas temperature after the after cooler to 50^0C. For calculating the surface area of the air cooler, the ambient air temperature of 44^0C and 80% RH shall be considered. Cooler design shall be on the basis of 20% excess capacity than required corresponding to suction pr. of 19 kg/cm2(g). Gas sections of coolers shall be designed as per API-661 requirements. Vibration switch shall be provided on the heat exchanger to trip the compressor on high vibration limit. Bidder shall indicate vibration level in the offer. For cooling of the Heat Exchangers a cooling fan to be provided inside the enclosure(s). Cooling system shall be preferably installed on the same skid as the compressor due to space constraints. Bidder shall submit cooler sizing calculation for review.

4.9 Separators & Oil Removal System

4.9.1 Carbon Steel separators / KOD / volume bottles with auto drain system shall be provided for the capacity as required.

4.9.2 All pressure vessels shall be designed as per ASME VIII Div 1.

4.9.3 All vessels including pulsation dampers shall be fully (100 %) radiographed as per ASME VIII UW (a) or equivalent.

4.9.4 Minimum design temperature for separators shall be 71^0C and minimum design pressure shall be maximum operating pressure plus 15% for inter-stages and plus 10% for final stage.

4.9.5 NRV shall be provided on suction, 1st stage, 2nd stage, 3rd stage separators /KOD /volume bottle drains.

4.9.6 Gas recovery system: Bidder shall provide blow-down tank to act as:

i. A buffer tank during start-up.

ii. Gas flow dampener during compressor operation

iii. Surge tank for depressurization of each of the compressor stage piston cylinders during shutdown.

iv. Blow-down tank size should be to manufacturer's design standards. The gas recovery

vessel shall be provided with pressure relief valve and necessary instrumentation to avoid cold flaring of gas.

v. Capacity shall be suitable to prevent any venting.

vi. Suction damper and gas recovery vessel shall preferably not be combined and one pressure regulator with isolation valve shall be provided to connect gas recovery vessel with compressor suction.

vii. If suction damper and gas recovery vessel are combined, pressure regulator after gas recovery vessel will not be allowed due to high pressure drop during compressor operation.

viii. One vent line from gas recovery vessel with double isolation valves shall be provided

4.9.7 All separators / KODs shall be provided with 3 mm corrosion allowance.

4.9.8 Oil from all drains shall be collected into the oil recovery pot. Oil recovery pot shall be provided with manual drain arrangement. Capacity shall be min. 15 water litres..

4.9.9 Coalescent super fine filters (preferably two stage) with CE mark/ Third party certification for removal of liquid (e.g. water & oil) and solid particles down to 0.1 microns out of compressed natural gas shall be provided. Residual Oil Contents shall be less than 1 PPM. Automatic drains with On-off valve connected to Gas recovery vessel shall be provided. The filter should be sized to flow min. 200% of the maximum flow at suction pressure of 19 kg/cm2g. However mechanical design shall be based on safety set pressure.

4.10 Pulsation, Vibration Control and Analog Study

4.10.1 Suitable arrangement for interstage pulsation damping shall be provided in confirmation to ISO 13631-2002.

4.11 Coupling

4.11.1 V-Belt drive up to 150 KW electric motor rating is acceptable. Direct drive shall be offered by the Bidder if electric motor rating is > 150 KW. Gear drive is not acceptable.

4.12 Enclosure of CNG Compressor Package

4.12.1 The maximum allowed temperature within the enclosure shall be 5°C above ambient temperature. Adequate ventilation fans/suitable arrangement shall be provided to meet the above and also to account for heat dissipation of the coolers.

4.12.2 The compressor package shall consist of single enclosure for Compressor and Electric Motor. The equipment shall be mounted on one common skid. The noise level of the enclosure shall be restricted to maximum 70 dB (A) at 1 meter from the enclosure.

4.12.3 Enclosures shall be weather proof and shall be provided with ventilation system.

4.12.4 The enclosures shall have doors for normal access for ease of maintenance of all the components.

4.12.5 All the pressure, temperature, lube oil pressure, coolant temperature, shall be visible from outside of enclosures as per the design of the manufacturer through gauge panel. However if due to space constraint some of the Instruments not visible from outside of enclosure then proper

accessibility has to be provided for reading the parameters from the Instruments. The Flow meters shall be installed in such a way that if required reading can be taken safely on running of compressor during performance testing.

4.12.6 Enclosures shall have internal flame proof lighting arrangement. The local control panel should also have flame proof lighting.

4.12.7 The Compressor shall be located inside an acoustic enclosure. All Coolers, Knock out Drums/Scrubbers/volume bottles, Cooling System, lubrication system along with interconnecting piping shall be inside an enclosure. Enough headroom shall be made available for easy access and maintenance of all equipment.

i. Components such as pressure gauges, temperature, pressure switches, filter automatic ball valves, safety valves etc., which require in-situ adjustment, maintenance and reading, shall be easily accessible.

ii. Tray/Conduits and tubing shall be arranged in orderly and systematic manner and shall be routed neatly to enter the back of display or monitoring panels

iii. Routine service item such as, but not limited to, crank case oil filters, inlet and outlets gas filters and drive belt shall be located to facilitate easy one- man servicing.

iv. One person should be able to access crank case oil inlet and drains to allow addition or drainage of oil without removing panels or adjacent components and without the need of the pump.

v. Items which must be operated & monitored during operation shall be readily accessible without opening the door.

vi. Suitable gradients shall be provided on the enclosure roof for rain drainage and to avoid water pockets.

vii. Communication/Control cables shall be routed through Cable Trays/conduits.

4.13 Piping

4.13.1 All gas piping shall be designed, fabricated & tested in accordance with ANSI B 31.3.

4.13.2 Low pressure Gas piping shall be seamless carbon steel manufacturing in accordance with ASTM A - 106 Grade B. All Gas piping shall be flanged connections. Pipe wall minimum thickness shall be in accordance with Table 4 of ISO 13631:2002.

4.13.3 All rigid piping, tubing & other components of compressor package shall be designed for full range of pressure & temp and loading to which they may be subjected with a factor of safety of at least 4 based on minimum specified tensile strength at specified ambient temperature.

4.13.4 All rigid piping shall be continuous between their respective components & free of connections except welded joints. All high pressure joints shall be welded unless otherwise not feasible.

4.13.5 The instrument air tubing material shall be minimum SS304 inside the compressor from main distribution header to instruments.

4.13.6 All high-pressure gas piping shall be of SS 316 material with double ferrule fittings and 2/3 way

valves. Material of tube shall be as per ASTM A269.

4.13.7 Bidder shall furnish a basket strainer fitted with adequate size mesh at the gas inlet before duplex filter. The free area of the strainer element shall be at least four (4) times the internal area of the connecting pipe lines. Flow area in any portion of Basket strainer assembly shall not be less than the pipe cross sectional area. The strainer element shall be with the mesh of 5 micron. Pressure drop in clean condition shall not be more than 4.0 MWC. Wire mesh of the strainers shall be suitably reinforced, to avoid buckling under operation. Strainer shall have screwed blow off connection fitted with a removable plug. The strainer will have a permanent stainless steel tag fixed on the strainer body indicating the strainer tag number and service and other salient data. The size of the strainer and the flow direction will be indicated on the strainer body casting. Thickness of the strainer element should be designed to withstand the pressure developed within the strainer due to 100% clogged condition exerting shut-off pressure on the element.

4.13.8 Pressurized lubricating oil lines downstream of the filter (with the exception of cast- in-frame lines or passages) shall be made of austenitic stainless steel. For either tubing or piping, bends shall be used to minimize the number of fittings wherever possible. Steel fittings shall be furnished with stainless steel tubing. Pressure piping downstream of oil filters shall be free of internal obstructions or pockets (such as those created by socket weld fittings) that could accumulate dirt at pipe joints. Non- consumable back-up rings and sleeve-type joints shall not be used. Other piping fittings shall be of the socket-weld or butt-weld type. When butt welds are necessary, such precautions as internal grinding of joints and use of gas tungsten- arc welding for the first weld pass shall be taken to prevent weld splatter inside the lines. After fabrication, oil lines shall be thoroughly cleaned and preserved. In addition, carbon steel piping shall be pickled and passivated.

4.13.9 External drain & vent piping shall be Carbon Steel and not less than 1" nominal size. However, all the internal drains shall be SS 300 series material.

4.13.10 Mercaptan / THT / (80% TBM+20%MES) Spotleak 12 ppm dosing is envisaged hence all materials coming in contact with gas shall be compatible to such gas with Mercaptan / THT / (80% TBM+20%MES) Spotleak 12 ppm dosing and be of compressor manufacture's standard. The use of SA 515 material is prohibited.

4.13.11 All piping after coalescent filter at compressor discharge shall be of SS 316.

4.13.12 The instrument air header & CO2 piping up to compressor enclosure shall be seamless CS.

4.13.13 All low pressure and high pressure gas piping joints fabricated at site / shop shall be 100% radiographed after welding.

4.13.14 All stud bolts and nuts shall be hot dipped galvanized as per ASTM A 153 or equivalent.

4.13.15 Design of piping systems shall achieve the following:

i. Proper support and protection to prevent damage from vibration or from shipment, operation and maintenance;
ii. Minimize loads on the nozzles of cylinders and pulsation suppression devices;
iii. Avoidance of pipework bending forces and/or introduction of adequate flexibility to minimize stress;

iv. Good accessibility for operation, maintenance and cleaning;
v. installation in a neat and orderly arrangement adapted to the contour of the machine and not obstructing access openings;
vi. Elimination of air pockets;
vii. Complete drainage through low points without piping disassembly;
viii. Elimination of low points in the inlet process piping including recycle/by- pass piping that could trap liquid;
ix. Use of pipe clamps on all gas piping and on all piping DN 50 (2 in) and larger;

4.13.16 Following certificates have to be submitted for piping fabricated at Site & shop

a. Electrode qualification test procedure
b. Proposed Welding procedure specification with impact test
c. Electrode qualification test results
d. Procedure qualification test results and final WPS
e. Welder's qualification test

5.0 ELECTRICS & INSTRUMENTATION CONTROL:

5.1 Starter/Control Panel/ Control philosophy

5.1.1 Doors of soft starter panel/Incomer panel shall be interlocked isolator. FLP Panel shall be complete with all FLP equipments like start and stop push buttons, indication lamps, fault reset button. All necessary timers and intrinsically safe relays to control the system on an automatic starting and stopping basis shall be provided. The compressor package control system shall be designed for unattended operation in automatic mode and in case of any fault it will go in a safe mode.

Push button for fault accept, fault reset, ESD, comp start, comp stop, scroll up, scroll down, enter, increment, decrement, back, hooter test, 05 nos. spares shall be provided.

Switch for auto manual selection, CO_2 cylinder main /CO_2 cylinder standby, 415 VAC supply on/off, 230 VAC supply on/off, tube light on/off, and 2 nos spares shall be provided. Lamp for 230 VAC on, 24 VDC PLC supply on , ready to start , running & trip, cooling fan running & trip and 3 nos. spares shall be provided.

5.1.2 Compressor Package shall be provided with a PLC based Local Control Panel cum operator panel (LCP), which shall be mounted on the package enclosure. PLC shall be housed inside flameproof IIA/IIB (Ex'd') enclosure. All the equipments / sub panel of LCP shall also be provided on the flameproof enclosure. All the interlock, monitoring and controlling of the CNG compressor package shall be done through PLC based control system which will be of proven type and make. PLC hardware shall be in accordance with IEC- 61131-2 and PLC programming shall be made only in ladder diagram, however PLC shall be capable to convert programmed in flow chart, functional block diagram, structural text etc in accordance with IEC-61131-3. PLC shall be provided with graphics display & scrolling facilities to view process & machine parameters. All source & object codes including logic flow chart, ladder diagram etc is to be furnished by the Packager during detailed engineering. Provision shall be made that the same can be viewed on client's Laptop.

5.1.3 PLC shall be suitable for recording of compressor parameters as indicated in instrumentation and all other parameters that are recommended by the compressor manufacturer for recording on hourly basis for the last 24 hours.

5.1.4 The units of measurement for flow shall be Kg/hr, for pressure shall be Kg/cm2 (g)

or and for temperature shall be degree C.

5.1.5 PLC shall be of modular in construction with redundant CPU with EEPROM, redundant interface module, redundant network switch, redundant power supply for CPU and HMI, redundant power supply for load, non-redundant I/Os, communication cards for connecting mass flow meter, communication card card/port for future SCADA connectivity.

5.1.6 Diagnosis feature shall be available in CPU and I/O used in PLC.

5.1.7 Mounting of PLC components such as CPU, HMI, I/Os in one JB/enclosure and power supply relay barriers/isolators, fuses, MCB, electrical earthling bus bar in other JB/enclosure. PLC components / system shall be tropicalised, adopted with complete wiring and necessary terminals. Wiring to be color-coded with cross printed ferruling in position.

5.1.8 Mass to volume calculation is not required; however, bidder shall provide a soft tag for entering standard density up to 2 decimal point with the help of external push button in PLC for converting mass flow rate to volume flow rate.

5.1.9 PLC shall communicate to clients central SCADA via GPRS. The PLC shall be provided with RS 485 (Modbus) / Ethernet port for interfacing with clients GPRS modem. Bidders shall provide all required hardware & software for establishing the communication with central SCADA. All the parameters on the PLC shall be configured to be available on clients central SCADA and details of the same (i.e memory mapping etc) shall be provided to the SCADA vendor. Providing necessary support and assistance during integration of the compressor with the SCADA is in Bidder's scope.

5.1.10 PLC shall be capable of carrying out on line routines for at least ten separate loops without affecting the scan, cycle & up dating time etc.

PLC programming shall be made only in Ladder Diagram, with comments in English for each Rung.

5.1.11 **Human Machine Interface (HMI)**

HMI shall be provided and operating system software (with minimum all the features of operator panel of model MP277B/TP1200 COMFORT min.10" graphic display of Siemens/Schneider), software's for interlocking, monitoring and control. All operational buttons shall be on touch screen except the Emergency stop button. Touch screen display system shall be weather proof to IP65. This should be provided in the flame proof panel with HMI mounted on the door of the panel. The HMI screen shall be back side of the toughened glass. During running of the compressor the HMI should be assessable through the external push button provided on the panel. The PLC shall be interfaced with SCADA in future. All the parameters on the PLC shall be available on the HMI. Bidder shall provide Application program for PLC, HMI on LCP (licensed one set) along with all interfacing adaptors and cables. Bidder shall also provide one set of source & object codes for PLC, HMI on LCP (in both forms, hard & soft).

5.1.12 All the parameters on the PLC shall be available on the HMI on single page or shall AUTO SCROLL (Interval shall be programmable) during Compress or Running/Stop mode.

5.1.13 The PLC System offered shall be supplied with monitor and memory card for processing of live data and stored data. PLC shall be capable of:

i. Compressor Control & Emergency Shut down ii. Fire and gas detection and monitoring

iii. Graphics, Data acquisition, monitoring & logging, viewing, modifying set point and range fall process parameters for which transmitters are provided.

iv. Record the last 20 Alarms of abnormal operations on separate page.

v. Viewing process diagram with on line data on line.

vi. Viewing trend of min. 10 critical parameters.

vii. Shall have historical as well as event recording system for at least last 200 events

viii. PLC shall be capable for display of flow meter data for flow rate and flow totalizer (i.e. Gas Suction, Gas Discharge), and power consumed by the motors, compressor running hour etc. in following manner:

a. Shift wise (for 3 shift operation i.e. 06:00-14:00, 14:00-22:00 & 22:00-06:00) - shall be available for at least last 96 hours with date stamping.

b. Daily basis- shall be available for at least last 31 days with date stamping

The above data will be viewed / analyzed offline (during shut down of compressor) on client's Laptop / Local PC or online through central SCADA via GPRS modem. Dedicated RS 485 (Modbus) / Ethernet port shall be provided for communicating with SCADA over GPRS. Necessary software for downloading data and processing as define above shall be provided. 10 Meter cable with suitable adaptor (if required) shall be provided.

5.1.14 The compressor package control system shall be so designed that the first item to go into alarm condition shall lock out to indicate the cause of the trip though the cause of the trip may have disappeared. The lock out condition shall be manually reset.

5.1.15 Where three bank cascade has been envisaged; in auto mode, compressor shall start automatically in case high bank storage pressure falls below 220 kg/cm2(g) and stop as soon as pressure in all three banks of stationery cascade and mobile cascade reaches 255 kg/cm2(g). Where only one bank cascade has been envisaged; in auto mode, compressor shall start automatically in case storage pressure falls below 220 kg/cm2(g) and stop as soon as pressure in cascade and mobile cascade reaches 255 kg/cm2(g). In manual mode the compressor shall also stop at 255 kg/cm2 (g) pressure. The priority fill system (In Bidder's scope) shall ensure the filling of vehicle, storage cascade and mobile cascade in correct sequence. Control system shall be designed such that in case of any fault, discrepancy or abnormality, it will go in safe mode. All controls shall be made in fail- safe mode & failure of any control shall not lead to operation of equipment/ system in unsafe condition.

5.1.16 In case of fault, a warning hooter shall operate, the sound of which should be audible at distance of at least 15 meter. Further the fault alarm and emergency stop PB shall be duplicated in the CNG station control room. Acknowledgement/resetting of fault shall be possible only from compressor panel. There shall be red and green indication at top of enclosure to indicate code no of alarm/trip in red color. List of alarm with code no shall be indicated on SS plate and to be fixed at compressor enclosure. Emergency stop PBs shall be mushroom head turn lockable type. Once the fault is acknowledged or compressor is under normal maintenance, the valves of priority panel shall take the position so that gas available in the stationary CNG storage cascade can be dispensed.

The points to be monitored for downstream of priority panel shall be:

i. Pressures in each bank of stationary storage cascades.

ii. ii. Pressure at outlet for dispenser.

iii. Control Air Pressure

iv. Indicators, Alarms and Trips as per Equipment Data Sheets

v. Pre alarm to be incorporated in the software before machine trips in predefined values of Pressure & temperatures

5.2 Calibration certificates required for all instruments such as Mass Flow Meter, Pressure transmitters, Pressure gauges, Temperature gauges, Temperature transmitters, Gas detectors, Flame detectors etc.

5.3 Vendor has to calibrate Pressure & Temperature instruments within 1 month of compressor commissioning or before Performance Guarantee testing.

5.4 Training to BGL team at site - functional & operational with PLC & instrumentation system. Training program and the procedure shall be provided for training at site

5.5 **Priority fill system as Online compressor:**

5.5.1 Case - I ; Valves positioned to take suction from LCV cascade.

a. If the LCV cascade pressure is more than 200 kg/cm^2, the gas dispensing should take place directly from LCV to dispenser bypassing online compressor.

b. Compressor shall start automatically when the LCV cascade pressure falls below 200 kg/cm^2(g).The priority of filling shall be as follows:

i. **First priority:** Priority panel shall first fill the vehicle through dispenser.

ii. **Second priority:** If no vehicle is to be fueled, priority panel shall fill the stationary cascade. The compressor shall shutdown automatically when either all stages of stationery cascade are filled to a pressure of 255 kg/cm2 (g) or pressure in mobile cascade is less than 16 kg/cm2 (g).

5.5.2 Case - II ; Valves positioned to take suction from stationary cascade

a) Dispensing shall be done through stationary cascade without compressor running, if stationary cascade pressure is more than 200 kg/cm^2 (g).

b) Compressor shall start on automatically if stationary cascade pressure is less than 200 kg/cm^2 (g). Dispensing into the vehicle should take place from the stationary cascade. Compressor shall trip if either there is no vehicle for fueling or pressure in stationary cascade is less than 16 kg/cm^2 (g).

5.6 **The priority fill system as On-line compressor:** The priority panel shall ensure the filing of vehicle, storage cascades & LCV in correct sequence. The priority fill system shall ensure 200-kg/cm2g pressure in CNG dispenser outlet port. Design of priority fill system shall be aimed to achieve maximum flow rate through combined flow from compressor and cascade arrangement. All priorities shall be with full bore ball valves having high CV and dedicated Pressure transmitter interlocked with PLC. Bidder shall indicate flow rate achievable through proposed priority fill system design. All tubing and valves for compressors having capacity up to 1200 SCMH shall be ¾" dia. sheeting work of priority panel shall be SS construction. All the pneumatic tubing for solenoid of priority shall be of SS 304 only.

Nos. of priority panel required shall be as per SOR/MR.

The details for various configuration of priority panel for different type of CNG stations including priority fill panel design to deliver the CNG shall be as follows:

5.6.1 TYPE –1 FOR MOTHER STATION: 9 LINE : A: When compressor is running

Priority no. one : Car dispenser Low bank
Priority no. two : Car dispenser Medium bank
Priority no. three : Car dispenser High bank
Priority no. four : Bus dispenser (Single bank filling)
Priority no. five : High bank of storage cascade
Priority no. six : Medium bank of storage cascade
Priority no. seven : Low bank of storage cascade
Priority no. eight : Bus cascade (Single bank filling)
Priority no. Nine : Mobile cascade mounted on Light commercial vehicle (single bank filling).

B: When compressor is not running:

When the compressor is not running, the valves of priority panel shall take the position so that gas available in the stationary car cascade and bus cascade can be dispensed. The priority of dispensing from car cascade shall be as follows;

Priority no One : Low bank of storage cascade
Priority no Two : Medium bank of storage cascade
Priority no Three : High bank of storage cascade

5.6.2 TYPE –2 FOR ON LINE STATION: 8 LINE : A: When compressor is running

Priority no one : Car dispenser Low bank
Priority no two : Car dispenser Medium bank
Priority no three : Car dispenser High bank
Priority no four : Bus dispenser (Single bank filling)
Priority no five : High bank of storage cascade
Priority no six : Medium bank of storage cascade
Priority no seven: Low bank of storage cascade
Priority no eight : Bus cascade (Single bank filling)

B: When compressor is not running:

When the compressor is not running, the valves of priority panel shall take the position so that gas available in the stationary car cascade and bus cascade can be dispensed. The priority of dispensing from car cascade shall be as follows;

Priority no One : Low bank of storage cascade
Priority no Two : Medium bank of storage cascade
Priority no Three: High bank of storage cascade
Priority no Four : Bus cascade (Single bank filling)

5.6.3 TYPE –3 FOR ON LINE STATION: 6 LINE : A: When compressor is running

Priority no one : Car dispenser Low bank

Priority no two : Car dispenser Medium bank
Priority no three : Car dispenser High bank
Priority no four : High bank of storage cascade
Priority no five : Medium bank of storage cascade
Priority no six : Low bank of storage cascade

B: When compressor is not running:

When the compressor is not running, the valves of priority panel shall take the position so that gas available in the stationary car cascade and bus cascade can be dispensed. The priority of dispensing from car cascade shall be as follows;

Priority no One : Low bank of storage cascade
Priority no Two : Medium bank of storage cascade
Priority no Three : High bank of storage cascade

5.5.4 TYPE –4 FOR ON LINE STATION: 7 LINE : A: When compressor is running

Priority no one : Car dispenser Low bank
Priority no two : Car dispenser Medium bank
Priority no three : Car dispenser High bank
Priority no four : Bus dispenser (Single bank filling)
Priority no five : High bank of storage cascade
Priority no six : Medium bank of storage cascade
Priority no seven : Low bank of storage cascade

B: When compressor is not running:

When the compressor is not running, the valves of priority panel shall take the position so that gas available in the stationary car cascade and bus cascade can be dispensed. The priority of dispensing from car cascade shall be as follows;

Priority no One : Low bank of storage cascade
Priority no Two : Medium bank of storage cascade
Priority no Three : High bank of storage cascade

5.7 Emergency Shut Down

Bidder shall provide emergency shut down (ESD) system in the control room as well as to be mounted locally near the Compressor and dispenser. Fail-safe system shall be designed and incorporated to isolate cascade storage from dispenser, stop compressor, and isolate the compressor suction and discharge lines. ESD switch shall have to be manually reset to restart the compressor package again. ESD shall activate either on pressing emergency push button (red button) or on fire detection. Red ESD button (05 nos.) shall be located in Control Room, Process Area Fencing, One in Compressor LCP, One on soft starter panel, One no. near dispenser.

5.8 Electric and control panel :

The electrical panel shall be flameproof construction and located on the compressor package. The electrical power supply distributions panels, switchgear panels and starter panels shall have flame proof construction. There shall be FLP push button panel available at the compressor skid suitable for hazardous area classification. The switchgear shall have one incomer and adequate

number of outgoing feeders. The incomers shall be provided with suitably rated fuse switch unit (AC – 23), ammeter, voltmeter with selector switch, energy meter, PF meter, Phase reversal relay, Earth fault relay, indication lamps etc. Motor feeders shall be provided with heavy duty fuse switch unit (AC – 23), contactors (AC-3 duty), bi- metal relay with built in single phase prevent, ammeter, push buttons, indication lamps for Start/Stop/Trip, etc. Adequate number of MCB feeders for control and lighting shall be provided. Bidder shall furnish single line diagram of the panel with the bid.

5.9 Push button for fault accept, fault reset, ESD, comp start, comp stop, scroll up, scroll down, enter, increment, decrement, back, hooter test, 05 nos. spares shall be provided.
Switch for main over ride, auto manual selection, CO2 cylinder main /CO2 cylinder standby, 415 VAC supply on/off ,230 VAC supply on/off, tube light on/off, enclosure door by pass and 2 nos spares shall be provided. Lamp for 415 VAC, 230 VAC on,
24 VDC PLC supply on, ready to start, running & trip and 05 nos spares shall be provided

5.10 All electrical equipments shall be suitable for the following supply conditions.

i. **Power supply for electrical control panel:** Electrical operating voltage: AC, 3 phases, 415 +/- 10%V, 50 +/- 5%Hz. Bidder to note that all control electronic / electrics shall be capable of withstanding voltage fluctuation specified.
ii. **Power supply for PLC based Control Panel** : Electrical control voltage: 230+/-5 % V, 50 +/-1 % Hz. Control supply through UPS shall be provided by the purchaser

5.11 List of Documents: (To be provided with each package).

i. Priority Panel & Air compressors OEM Tests Certificates.
ii. Instrument Calibration certificates: GD, FD, TG, TT, PT, PG, PS, VS, MFM, PCV.
iii. SRV, Pressure vessel Test certificates
iv. PLC Program, PLC Display Program (Password Free)
v. Software for communication.
vi. Communication Cable & Adaptor.
vii. Logic Diagram/ Ladder Diagram (Comments in English).
viii. Alarm / Shut Down List with set points.
ix. Operating / Control write up

6.0 ELECTRIC MOTOR AND DRIVE ARRANGEMENT

6.1 Selection of Electric motors

The site rating of electric motor shall be max of the following two conditions;

a. 110% of greatest BkW required by compressor including cooling fan , other auxiliaries and the losses at any of the compressor operating conditions corresponding to suction pr. of 16 kg/cm^2(g), 17.5 kg/cm^2(g) or 19 kg/cm^2(g) with suction valve fully opened and discharge pressure 255 kg/cm^2(g) for MR item no.1.

b. 105% of greatest BkW required by compressor including cooling fan , other auxiliaries and the losses at any of the compressor operating conditions corresponding to suction pr of 16 kg/cm2(g), 17.5 kg/cm2(g) or 19 kg/cm2(g) with suction valve fully opened and discharge pressure at relief valve (RV) set pressure. Starting torque shall be checked at all suction pressure conditions.

6.2 CODES & STANDARDS

The squirrel cage induction motors and their components shall comply with the latest applicable Indian standards listed below. Where Indian standards do not exist, the relevant IEC or British standards (as specified elsewhere in this document) shall apply.

IS – 325	Three phase induction motors.
IS – 4029	Guide for testing 3-phase induction motors.
IS – 46	Degree of protection provided by enclosures for rotating electric machines
IS – 6362	Designation of methods of cooling for rotating electrical equipment.
IS – 2148	Flameproof enclosures for electrical apparatus.
IS – 5571	Guide for selection of electrical equipment for hazardous area.
IS – 12075	Measurement & evaluation of vibration of rotating electrical machinery

6.3 CERTIFICATION

Certificates from statutory authorities like CMRI / DGMS/PESO shall be submitted indicating suitability of motors, control panels and emergency push button etc. in hazardous area.

Motor accessories (If applicable):

a. Compressor grooved flywheel
b. Motor grooved drive pulley
c. Drive vee belts
d. Flexible coupling for direct drive
e. Drive guard
f. Adjustable motor slide rails for vee belt tensioning

6.4 Other Requirement of Motor:

6.4.1 Motors shall be provided with 230 V anti-condensation heaters, sized and located so as to prevent condensation of moisture during shutdown periods. The heaters shall permanently remain 'ON' when the motor is not in service and as such shall not cause damage to the windings.3 nos. of PTC130 thermistor 1 per phase shall be provided for motor ratings >45KW & <200 KW along with suitable double compression cable glands etc.

6.4.2 Motor shall be TEFC squirrel cage type in standard frame size as per IS 12615: 2011, IS : 2148, IS 4691 and other relevant standard/IEC rated for continuous duty with high efficiency (IE2) and designed for soft starter starting. Motors shall be suitable for starting under specified load conditions with 75% of rated voltage at the terminals. Motor torque shall be compatible with speed torque curve of compressor. Motor windings shall be class 'F' insulated with temperature rise limited to class 'B'. Minimum degree of protection of motor enclosure shall be IP55 as per IS. Motors for use in hazardous areas shall have protection Ex (d) as per area classification. Soft starter for electric motor > 45 Kw shall be provided, unless otherwise mentioned elsewhere, by the bidder.

6.4.3 The motor name plate rating (exclusive of service factor) shall be minimum 110% of the greatest

HP required under any of the specification operating conditions. All motors shall be tested in accordance with IS/IEC.

6.4.4 Each motor shall compulsorily be protected with thermal-magnetic over current relay

6.4.5 Pre-lubricated sealed bearings for all motors may be considered provided a full guarantee is given for 4 to 5 years of trouble - free service without necessity of re- lubrication.

6.4.6 Vibrations: Motor vibration shall be within the limit of IS-12075.

6.4.7 Noise level: Permissible noise level shall not exceed the stipulations laid down in IS-12065.

6.5 SOFT STARTER / INCOMER PANEL

Floor mounted soft starter panel of 2.0 mm thick CRCA sheet steel enclosure(IP-52) shall consist of following & complete in all respect including bus bar chamber, cable alley, incomer and outgoing feeder with contactors(AC-23), MCCB/MPCB and over load relay of suitable rating, Push Buttons, Indicating Lamps(LED cluster type) etc.

The switchgear shall have one incomer and adequate number of outgoing feeders. The incomers shall be provided with suitably rated MCCB/MPCB ammeter with selector switch, voltmeter with selector switch, power meter, indication lamps, voltage monitor relay etc. Motor feeders shall be provided with MCCB/MPCB ,contactors (AC-3 duty), bi-metal relay with built in single phase prevent, ammeter with selector switch, push buttons, indication lamps for Start/Stop/Trip, earth leakage relay for motor rating above 5.5 KW etc. Adequate number of MCB feeders for control and lighting shall be provided. Bidder shall furnish single line diagram of the panel after award of the contract. Fuse less design shall be followed.

6.5.1 CONTROLLER

Specification describes the requirements for a solid-state torque controlled starter used to provide linear ramp starting and stopping of three-phase flame proof AC induction motor for CNG compressor. The requirement is for a stand-alone unit that negates the need for further equipment in terms of protection, viewing and controlling.

A. Electrical ratings

a. 415 ±10% Volts AC mains b. 50- Hz ± 5%

B. The Controller shall provide following "starting" modes:

a. Linear Torque control for Start

b. Starting with CNG compressor

c. Current Limit Start

d. Voltage ramp Start

C. The Controller shall provide following "stopping" modes:

a. Linear Torque control for Stop

b. Stopping of CNG compressor

c. Voltage ramp Stop

D. The Controller shall provide following "Protection" features:

i. Motor Thermal Overload

iii. Soft Start thermal overload

iv. Phase imbalance

iv. Phase reversal v. Over voltage

vi. Under voltage vii. Locked Rotor

viii. Electronic over load

E. The Controller shall provide following "displays in seven segment functions:

a. Three Phase Current b. Three Phase Voltage c. Current in L1, L2, L3

d. Voltage between L1-L2, L1-L3, L2-L3 e. Shaft Power in kW / HP (selectable)

f. Motor thermal capacity

g. Motor Energy consumption (kWh)

h. Power factor

i. Run time in hours

j. Heat sink over temperature

F. The Controller shall provide as standard, the following "Fault Indication" functions:

a. Line failure

b. Phase imbalance

c. Over temperature - motor

d. Over temperature - Soft Starter

e. Locked Rotor

f. Overload - Shaft Torque

g. Underload - Shaft Torque

h. Phase imbalance

i. Over voltage

j. Under voltage

k. Excessive Starts

l. Phase reversal

6.5.2 CODES AND STANDARDS:

The controller shall be designed to meet the applicable requirements of IEC 947-4-2.

7.0 CABLING (ALL SUITABLE FOR HAZARDOUS AREA APPLICATIONS)

7.1 Control Cable inside the compressor package shall be of 1.5 Sq. mm and for outside compressor package shall be 2.5mm.

7.2 Cables shall be1100-volt grade, stranded copper conductor, XLPE insulated, PVC sheathed, round wire/flat armoured, FRLS cables.

7.3 Cables shall be terminated using double compression type metallic frame proof glands and

copper lugs.

7.4 Spare cores to be kept in each control cable.

7.5 All JB's shall have flame proof metallic enclosure.

7.6 All the signal cables shall be screened armoured cables.

7.7 All the control and power cables shall be armoured cables.

7.8 All the communication cables shall be screened and shall be terminated to JB through threaded GI conduits only.

7.9 Communication/Control cables shall be routed through Cable Trays/conduits.

7.10 Following cables shall be supplied, laid and terminated by bidder:

a. Cables inside the compressor package

b. Control and signal communication cables from soft starter panel to compressor package.

c. Termination of cables in compressor control panel, soft starter panel including cable lugs and double compression glands etc. is in the bidder's scope.

d. Bidder shall furnish following electrical data along with bid:

SI. NO.	DESCRIPTION	TO BE FILLED BY BIDDER	REMARKS
1	**CABLES FOR PROCUREMENT AND ERECTION BY BIDDER**		The same shall be in the scope of bidder
	a) From PDB to soft starter to compressor (three phase)		
	b) From UPS ACDB to compressor control panel (single phase)		
	c) From compressor to hooter and upto ESD push button in control room.		
	d) From compressor to ESD push button Near dispenser.		
	e) From PDB to Air compressor in CNG station area		
	f) From CO2 flooding system to compressor		
	g) From manual switch/call point of CO2 flooding system (located in		
	control room) to compressor skid		
	h) Form LDB to Air Dryer		
	i) Cables from Compressor skid to ESD push button in process area.		
	j) Control and signal communication cables from starter panel to compressor package		

2	FEEDER RATING IN PDB PANEL		
	a) FOR AUXILIARY LOAD (lights inside enclosure, exhaust fan etc.)	---- AMP	for providing feeder in PDB by client
	d) FOR AIR COMPRESSOR	---- AMP	
3	UPS LOAD	------ KW	
4	NON UPS LOAD	------ KW	

8.0 INSTRUMENTATION DESIGN

8.1 All Instruments shall be suitable for an area classification of “Class 1, Group D, Division 1 as per NEC” OR “Zone 1, Group IIA /IIB as per IS/ IEC”.

8.2 All package mounted transmitters & temperature element shall be intrinsic safe "ib" as per IEC 79-11 and solenoid valves, switches and related junction boxes shall be flame proof “D" as per IEC 79-1. Other special equipment's/instruments, where intrinsic safety is not feasible or available, shall be flame proof as per IEC 79-1.

8.3 The compressor package instrumentation & control is to be configured for manual as well fully automatic control system including starting, shutdown as applicable for unattended operation. Control system shall be PLC based of a reputed make and proven type.

8.4 Electrical instrumentation shall be certified by a recognized authority such as BASEEFA, PTB, LCIE, CESI, INIEX, CMRS or any agency approved by Indian Government.

8.5 All the instrumentation shall be capable of operating for full range of operation.

8.6 All the process connection for instruments should have isolation valve of SS only.

8.7 Separate junction boxes shall be provided for each type of signal i.e., analog, digital, solenoids, RTD thermocouple and power supply. This is not applicable for direct run cables.

8.8 RTD shall be 3 wire PT-100 and thermocouple shall be K type and solenoid valve shall be 24 V DC operated.

8.9 Power cable, analog signal cable, digital signal cable shall be separately laid and properly tagged with metallic tag at both end.

8.10 All pressure gauges and pressure transmitters shall be provided with isolation valves and have accuracy of + or - 1% of FSD and + or - 0.25% of FSD respectively.

8.11 Pressure transmitters shall be fixed range type with 2 wire 4 to 20 mA transmitter of piezo resisitive suitable for CNG applications except at suction and discharge which is 2 wire smart type 4 to 20 mA transmitter with integral display and IP 67 certified & ex-proof.

8.12 The temperature gauge shall be generally gel in steel filled type, weatherproof & with capillary extension. Capillary tubing shall be min Carbon Steel with CS flexible armoring.

The gauge shall have accuracy of + or - 1% FSD. The range shall be 1.5 times of operating temperature.

8.13 Units of measurement shall be:

GAS FLOW : SCMHr & kg/hr

PRESSURE : kg/cm2 (g)

TEMPERATURE : ^{0}C

8.14 One no. of dedicated Serial Communication Port shall be provided for programming the PLC through Laptop with required adapter, cable, software, etc. Necessary adopter if required shall be under scope of vendor. Also, Vendor shall include one set of all licensed relevant Software (Windows based system configuration software and application program) for accessing the PLC, HMI and mass flow meter through client's PC / client's Laptop. All the parameters available on the PLC shall be communicated to client's central SCADA system through dedicated RS 485 port (Modbus) / Ethernet port. The detail requirement of SCADA will be communicated to successful vendor during detailed engineering.

8.15 Following points to be noted regarding Mass Flow meter- Coriolis type required at Suction, Discharge.

8.15.1 Each Mass Flow meter shall include a sensor with integral transmitter i.e. meter electronics certified intrinsically safe/explosion proof by statutory authority suitable for the required hazardous area as per IS-2148 /IEC-79. Also the offered sensor and the transmitter shall be weather proof to IP 65 as per IS- 2147/IEC-529. Statutory authority for local installation is CCOE/ PESO.

8.15.2 For online Calibration of MFM; Vendor to provide suitable arrangement to connect Master Mass flow meter (Prover) with Compressor Suction & Compressor Discharge flow meter for calibration purpose. Indicate and provide the details in P&ID.

8.15.3 Offered mass flow-meter shall be necessary for Custody Transfer application and accuracy should be in the range of 0.5% of span. Type approval Certificate from W& M India is required. Vendor has to calibrate all instruments including mass flow meter & perform Pressure vessel testing within 1 month of compressor commissioning. Vessel testing date and due date for retesting to be painted on all vessels.

8.15.4 Flying lead type electrical termination is not acceptable. All electrical connections shall be ½" NPTF. Cable glands shall be provided for electrical power, signal and control connections. Cable glands shall be double compression type and certified weatherproof and explosion proof for the required area classification as per IS-2147 and IS-2148.

8.15.5 Offered Mass flow meter shall be completely free from corrosion of measuring tube due to alternating stresses continuously occurring in the tube. Also measuring tube shall be completely free from erosion, which may result due to fluid velocity.

8.15.6 The design of meter electronics shall be in compliance with the electromagnetic compatibility requirements as per IEC-801.

8.15.7 Meter Electronics shall include all the associated pre-amplifiers converters, line riser etc and shall have enough diagnostic facility to correct live zero, variation, meter factor etc with help of Laptop.

8.15.8 Mass flow meter should be interface with PLC on serial communication. Mass flow meter shall be powered by 24 V DC only.

8.15.9 Installation details as per AGA-11 recommendations have to be followed. For horizontal /vertical installation, supports etc OEM recommendations shall be followed and to be provided.

8.15.10 Vendor shall calibrate each Mass Flow meter from the statutory authority of country of origin (OEM certificate only) or any recognized test house (for India from FCRI) with the fluid for which it is to be used. In case it is not possible to calibrate the Mass Flow meter with actual fluid. Vendor must indicate.

i. Fluid used for calibration

ii. Correction factor/Adjustment required for actual process fluid. In any case, inaccuracy when extended to actual process shall not exceed the specified limits (as per manufacturer's standard).

The calibration certificate should be valid for at the time of supply. The validity of calibration will be considered one year from the date of calibration. If the same is expired then the recalibration has to be done from FCRI as per the latest NABL/IS standards with the fluid.

8.15.11 Vendor shall submit the following test certificates and test reports for purchaser's review:-

i. Material test certificate with detailed chemical analysis from foundry (MIL Certificate).

ii. Certificate of radiography / x-ray for any welded joint.

iii. Hydrostatic test report with pressure of 1.5 times the design pressure.

iv. Calibration report including calibration factors for each Mass flow meter certificate from statutory body for offered sensor and transmitter for required area classification.

v. W&M India certificates.

8.15.12 CERTIFICATION:

The requirement of statutory approvals for usage of equipment / instruments / system in electrically hazardous areas shall be as follows:

a. The vendor shall be responsible for obtaining all statutory approvals, as applicable for all instruments and control systems.

b. Equipments / instruments / systems located in electrically hazardous areas shall be certified for use by statutory authorities for their use in the area of their installation. In general, the following verification shall be provided by the vendor.

i. Bidder shall provide certificates (from BASEEFA FM, UL, PTB, LCIE etc.) from country of origin for all intrinsically safe/flameproof protected by other methods equipment/instrument/systems, which are manufactured outside India. If required, bidder shall provide necessary certification / approvals / authentication, for all such intrinsically safe
/flame proof equipment / instrument / systems, by the Indian authority- Chief Controller of Explosive (CCOE) / PESO, Nagpur, India.

ii. For all flame proof equipment manufactured within India, the testing shall be carried out by any of the approved testing houses- Central Mining Research Institute (CMRI) / ERTL etc. The item shall in addition bear the valid certification

from CCOE / PESO and also the manufacturer shall hold a valid Bureau of Indian Standards (BIS) licence.

8.15.13 For all intrinsically safe equipment manufactured within India the testing shall be carried out by any of the approved testing houses - Central Mining Research Institute (CMRI) / ERTL etc. The item shall in addition bear the valid certification from CCOE.

9.0 EARTHING OF EQUIPMENT:

9.1 Bidders shall make provisions for earthing of the complete package as required as per IS (Earth pits are not in Bidder's scope). All electrics shall comply with latest IS/IEC. Epoxy based paints shall be applied on all electrical equipments. Bidder's scope shall include obtaining statutory approvals for the complete package, wherever necessary.

9.2 Dedicated Instrumentation earthing has to be provided.

9.3 Metallic part of all equipment not intended to be alive shall be connected to earth as per provisions of IS: 3043/IEC recommendation. Grounding of all electronics shall be separately connected to earth using insulated copper wire. Grounding of electronic equipment shall not be connected to earthing for electrics or equi- potential bonding

10.0 INSPECTION AND TESTING

10.1 General

a. Inspection and Test Requirements have been spelled out in respective Equipment Data Sheets and this Technical Specification.

b. Bidder shall confirm compliance to all inspection and testing requirements stipulated therein and include the inspection charges in the lump sum cost.

c. Owner/consultant shall witness tests as per data sheet and this specification. The Bidder shall notify the timing of such inspection and testing at least 15 days in advance to PURCHASER / CONSULTANT. PURCHASER / CONSULTANT shall depute their representative for witnessing the tests.

d. Bidder shall submit detailed Test Procedure for Approval of the Purchaser two months in advance of the actual date of conducting each test.

e. Inspection testing for foreign bidder: Cost of third party inspection including fees payable and arranging the same shall be borne by bidder. Approved 3rd party inspection agencies are CEIL, BVQI, DNV, and Lloyd's reg/TUV/AB-Vincotee/SGS/American bureau services/ Velosi certification services/International certification services limited/BV/ Dr. Amin Controllers Pvt. Ltd..

f. Inspection testing for Indian bidder: Owner/Consultant shall carry out Inspection and testing as per QAP, inspection charges shall be considered @1.0% of the ex-works price excluding duty and taxes of the equipment for price evaluation purpose only. Domestic bidder shall also arrange 3rd party for inspection as indicated in QAP and expenses on third party inspection including fees payable and arranging the same shall be borne by bidder.

10.2 Mechanical running test (MRT)

10.2.1 The MRT for the each compressors shall be carried out in presence of PURCHASER/CONSULTANT with job or shop driver including complete job driving system i.e., job driven V-belt, job pulleys etc., for 4 hours continuously at shop of compressor manufacturer. The compressor need not be pressure loaded for MRT test. During this test following shall be recorded at agreed intervals.

a. Vibration levels measured on cylinders and frame.

b. Bearing temperature.

c. Oil cooler inlet and outlet temp.

d. Sound level

Subsequent to satisfactory run, the compressor shall be examined as per standard procedure & following shall be examined as minimum:

Internal Inspection certificate for strip test after no-load run of compressor is to be submitted for review of BGL.

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Strip test is limited to open Crank Case cover, X-Hd guide & Dist.pc. Cover and opening of bore & other parts, piston, one valve per cylinder. Visual examination of position rod.

If any of part found damaged, all similar components shall be stripped for inspection. The MRT test shall be repeated after replacement of such parts.

10.2.2 All the interlocking and performance of the instrumentation system will be verified during the MRT.

10.3 Mechanical String Test

10.3.1 Mechanical String Test for 4 hrs shall be performed at packager's shop before dispatch in presence of Purchaser/Consultant. This test can be clubbed up with the Mechanical Run Test of compressor as specified above, provided the job driver, lube Oil system is used for the test. Air/N2 can be used for string test purpose if natural gas is not available in the shop. All parameters including discharge pressure shall be demonstrated. All the interlocking and performance of the instrumentation system will be verified during the MST. String test at unload condition is not acceptable.

10.3.2 Compressor capacity during string test

The string test for this compressor shall be performed at suction pressure 16 kg/cm2 (g) for 4 hrs continuously and the capacity shall be recorded. In case the capacity is found to be not meeting the requirement, the compressor shall not be accepted.

10.4 Package Performance Test (PT)

Bidder shall assemble the complete package including auxiliary systems, instrumentation, safety devices within the enclosure at his shop and dispatch. Duration of PG test shall be min. 4 hours continuously. Complete package shall be performance tested as a module along with electric motor & compressor as per Performa (to be decided during engineering). Bidder shall demonstrate all controls, shutdown, trips & alarms, functioning of Instrumentation system, PLC, Motor / Gas engine etc. **Pressure and temperature of gas shall be considered at purchaser's boundary limit (or before filter unit of package if provided) and as indicated in the Instrumentation schedule; if provision not available then supplier shall install necessary pressure and temp measuring devices**. Discharge PT & TT of compressor will use for discharge pressure and temperature measurements. All instrument duly calibrated, tools & tackles, any modification required for conducting PT shall be in the scope of supplier.

The PT shall be conducted only after 30 days' running of the machine after successful commissioning or after 30 days from the date of commercial operation, but not later than 90 days from the date of commercial operation of the machine. The delay in conducting PT beyond 90 days shall be liable for PRS unless such delays are solely attributable to the owner (i.e, due to inadequate load, ie, non- availability of CNG vehicles for conducting PT). **Refer Payment terms clause no.1.1.3 & 1.2 for payment towards PGT If PGT cannot be conducted due to reasons directly attributable owner. If the CNG load is not available for running the compressor for continuous 4 hrs even after 6 months from the date of commissioning, BGL shall allow to conduct PGT for a lesser period based on availability of load for a duration of min.30 mins.**

10.4.1 The test shall be the basis of assigning penalties on the Bidder, acceptance / rejection of the package thereon. Bidder shall submit the detail test procedure for the same, which shall be approved by PURCHASER/CONSULTANT. The test for the package shall be witnessed by PURCHASERL/CONSULTANT

10.4.2 Bidder to note that prime mover speed correction shall not be allowed below guaranteed speed. **Temperature and pressure will be considered at purchaser's boundary limit if provision is not available at compressor suction and discharge as explained above.**

11.0 PRICE LOADING AND COMPENSATION FOR UNDER PERFORMANCE

i) FOR 1200 SCMH COMPRESSORS:

a) This section describes the guaranteed parameter, which the CNG compressor package must fulfill and the penalty for shortfall in guaranteed parameters and rejection of compressor package by the Purchaser.

b) The guaranteed parameter shall be adjusted to account for variation in gas composition and prevailing ambient condition during testing.

c) Necessary calculations hall have to be furnished by Bidder, which shall be final and no deviation shall be permitted afterwards.

d) In case of any inconsistency in manufacture and/or operation of supplied compressor package, Bidder shall at his own risk and cost, eliminate the defects to the satisfaction of Owner.

Bidder shall furnish guaranteed values as per Cl. No.18 of this specification.

11.1 Compressor Capacity

Bidder shall guarantee 1200 SCMH capacity of compressor with design case gas composition, at suction pressure of 16 kg/cm^2(g) and at suction temperature of 30^{o}C, discharge pressure of 255 kg/cm^2(g) with no negative tolerance for errors in instruments and measurements.

Since the compressor suction pressure varies from 16 kg/cm^{2}g to 19 kg/cm^{2}g at present, the compressor shall be suitable to deliver flow of 1200 SCMH corresponding to 16 kg/cm^{2}g to 19 kg/cm^{2}g at present.

For calculation purpose 1kg of CNG =1.33 SCM

The same shall be used to establish the capacity at test bed during package performance test.

In both the above cases the driver shall be selected corresponding to max capacity. Mechanically the compressor shall be suitable to operate from min to max suction pressure without throttle and suction valve full open condition. Bidder to note that the suction pressure and temperature shall be measured at vendor's boundary limit and not at compressor cylinder.

Bidder shall guarantee compressor capacity in SCMH as per MR item no. for design case gas composition, suction pressure and suction temperature as specified against guaranteed condition with discharge pressure of 255 kg/cm^2(g) with no negative tolerance for errors in instruments and measurements. Mechanically the compressor shall be suitable to operate from min to max suction pressure without throttle and suction valve full open condition.

11.2 Loading & Compensation Criteria

This section describes the guaranteed parameter, which the CNG compressor package must fulfil, the penalty for shortfall in guaranteed parameters and rejection of compressor package by the Purchaser.

The guaranteed parameter shall be adjusted to account for variation in gas composition and prevailing ambient condition during testing.

Necessary calculations correction curves shall have to be furnished by Bidder along with bid, which shall be final & no deviation shall be permitted afterwards.

In case of any inconsistency in manufacture and/or operation of supplied compressor package, Bidder shall at his own risk and cost, eliminate the defects to the satisfaction of Owner.

Bidder shall furnish guaranteed value as per Annexure enclosed with this specification

A. Package Gas Loss:

The bidder shall design the compressor package so that no venting and leakage of gas takes place. Bidder shall indicate actual vent & leakage losses through the compressor package. If package loss is quoted more than 1% of suction capacity gas consumption than bid shall be rejected. This quoted figure will be used for evaluation and total quoted price for all compressors towards supply, special tools and tackles, transportation, erection & commissioning, operations and comprehensive maintenance will be calculated as per following formulas:

F = G x H x I x N x W Where,
F = amount in Rs.
G = Vent/Leakage rate quoted in percentage
H = Cost of Natural Gas per Kg @ Rs. 52/- per kg
I = Avg. no. of running hours per year i.e. @ 3650 hours
N = Number of machines
W = 900 kg for 1200 SCMH

B. Engine Power Consumption:

The compressor package shall be designed in such a way that Power Consumption of the Motor (KW/HR) should be minimum for production of CNG.

Bidder shall indicate actual gas consumption for their compressor package. This quoted figure will be used for evaluation and total quoted price for all compressors towards supply, special tools & tackles, erection and commissioning will be calculated as per following formulas:

F = G x H x I x N
Where, F = amount in Rs.
G = Bidder's Power consumption rate quoted in KW/HR for every 1200SCMH (900 Kg) of CNG produced.
H = Cost of Natural Gas per KW/HR @ Rs. 11/- per KW/HR
I = Avg. no. of running hours per year i.e. @ 3650 hours
N = Number of machines

Notes:

1. Power Consumption quoted by the bidder under guaranteed parameters shall lie within the range of 142 to 146 KW/HR for 1200 SCMH. No benefit will be given below 142 KW/HR for 1200 SCMH. In case the power consumption quoted by the bidder exceeds the upper limit i.e. 146 KW/HR for 1200 SCMH, the bid will be rejected.

2. The amount (F) as per the above calculations for 5 years shall be considered on NPV basis with discount factor @10% p.a.

ii) FOR 600 SCMH COMPRESSORS:

e) This section describes the guaranteed parameter, which the CNG compressor package must fulfill and the penalty for shortfall in guaranteed parameters and rejection of compressor package by the Purchaser.

f) The guaranteed parameter shall be adjusted to account for variation in gas composition and prevailing ambient condition during testing.

g) Necessary calculations hall have to be furnished by Bidder, which shall be final and no deviation shall be permitted afterwards.

h) In case of any inconsistency in manufacture and/or operation of supplied compressor package, Bidder shall at his own risk and cost, eliminate the defects to the satisfaction of Owner.

Bidder shall furnish guaranteed values as per Cl. No.18 of this specification.

11.3 Compressor Capacity

Bidder shall guarantee 600 SCMH capacity of compressor with design case gas composition, at suction pressure of 16 kg/cm^2(g) and at suction temperature of 30^{o}C, discharge pressure of 255 kg/cm^2(g) with no negative tolerance for errors in instruments and measurements.

Since the compressor suction pressure varies from 16 kg/cm^{2}g to 19 kg/cm^{2}g at present, the compressor shall be suitable to deliver flow of 600 SCMH corresponding to 16 kg/cm^{2}g to 19 kg/cm^{2}g at present.

For calculation purpose 1kg of CNG =1.33 SCM

The same shall be used to establish the capacity at test bed during package performance test.

In both the above cases the driver shall be selected corresponding to max capacity. Mechanically the compressor shall be suitable to operate from min to max suction pressure without throttle and suction valve full open condition. Bidder to note that the suction pressure and temperature shall be measured at vendor's boundary limit and not at compressor cylinder.

Bidder shall guarantee compressor capacity in SCMH as per MR item no. for design case gas composition, suction pressure and suction temperature as specified against guaranteed condition with discharge pressure of 255 kg/cm^2(g) with no negative tolerance for errors in instruments and measurements. Mechanically the compressor shall be suitable to operate from min to max suction pressure without throttle and suction valve full open condition.

11.4 Loading & Compensation Criteria

This section describes the guaranteed parameter, which the CNG compressor package must fulfil, the penalty for shortfall in guaranteed parameters and rejection of compressor package by the Purchaser.

The guaranteed parameter shall be adjusted to account for variation in gas composition and prevailing ambient condition during testing.

Necessary calculations correction curves shall have to be furnished by Bidder along with bid, which shall be final & no deviation shall be permitted afterwards.

In case of any inconsistency in manufacture and/or operation of supplied compressor package, Bidder shall at his own risk and cost, eliminate the defects to the satisfaction of Owner.

Bidder shall furnish guaranteed value as per Annexure enclosed with this specification

A. Package Gas Loss:

The bidder shall design the compressor package so that no venting and leakage of gas takes place. Bidder shall indicate actual vent & leakage losses through the compressor package. If package loss is quoted more than 1% of suction capacity gas consumption than bid shall be rejected. This quoted figure will be used for evaluation and total quoted price for all compressors towards supply, special tools and tackles, transportation, erection & commissioning, operations and comprehensive maintenance will be calculated as per following formulas:

F = G x H x I x N x W Where,
F = amount in Rs.
G = Vent/Leakage rate quoted in percentage
H = Cost of Natural Gas per Kg @ Rs. 52/- per kg
I = Avg. no. of running hours per year i.e. @ 3650 hours
N = Number of machines
W = 900 kg for 1200 SCMH

B. Engine Power Consumption:

The compressor package shall be designed in such a way that Power Consumption of the Motor (KW/HR) should be minimum for production of CNG.

Bidder shall indicate actual gas consumption for their compressor package. This quoted figure will be used for evaluation and total quoted price for all compressors towards supply, special tools & tackles, erection and commissioning will be calculated as per following formulas:

F = G x H x I x N
Where, F = amount in Rs.
G = Bidder's Power consumption rate quoted in KW/HR for every 600SCMH (450 Kg) of CNG produced.
H = Cost of Natural Gas per KW/HR @ Rs. 11/- per KW/HR
I = Avg. no. of running hours per year i.e. @ 3650 hours
N = Number of machines

Notes:

1. Power Consumption quoted by the bidder under guaranteed parameters shall lie within the range of 72 to 76 KW/HR for 600 SCMH. No benefit will be given below 72 KW/HR for 1200 SCMH. In case the power consumption quoted by the bidder exceeds the upper limit i.e. 76 KW/HR for 600 SCMH, the bid will be rejected.

2. The amount (F) as per the above calculations for 5 years shall be considered on NPV basis with discount factor @10% p.a.

11.5 PENALTIES

11.5.1 Penalty towards Excess Package Gas Loss:

During the O&M period, cost towards excess gas loss beyond the quoted figure shall be deducted from O&M bills.

Following calculations shall be used for deduction towards excess gas loss:
F = 1.2 x [(G-(Q*D)) *H]
Where, F = Penalty in Rupees to be deducted from O&M bill
G = Monthly Vent/Leakage loss observed during O&M period in Kg
Q = Vent / Leakage loss quoted in percentage
H =Cost of Natural Gas per Kg (Prevailing rate of natural gas on the 1st day of the particular month shall be considered)
D = Production of CNG during the month in Kg (discharge meter)

Considering "G" above shall be taken as (Suction Reading – Discharge Reading – Engine Fuel Consumption Reading of Mass Flow meters)OR Reading from Vent Mass Flow Meter, whichever is higher.

11.5.2 Penalty towards Excess Engine Fuel Consumption:

During the O&M period, cost towards excess fuel consumption beyond quoted figure shall be deducted from O&M bills.
Following calculations shall be used for deduction towards excess fuel consumption:
F = 1.2 x [(G-Q*D) x H]
Where, F = Monthly Penalty in Rs. To be deducted from O&M bills
G = Monthly Actual Gas consumption in Kg
Q = Guaranteed consumption rate quoted by supplier x CNG produced during the month
H = Cost of Natural Gas per Kg (Prevailing rate of natural gas on the 1st day of the particular month shall be considered)
D = Production of CNG during the month in Kg (discharge mass flow meter)

11.5.3 Penalty towards Package Efficiency Loss

Rs. 2/ Kg will be recovered for delivering each kg lesser than the rated capacity & following calculations shall be used:
F = 2 x {(1200 x H x RD x AD) – M} For 1200 SCMH Compressors
And
F = 2 x {(600 x H x RD x AD) – M} For 600 SCMH Compressors
Where,
F = Penalty Amount in Rupees
H = Package actual running hours in a month
RD = Average RD for the month using GC Data
AD = Air Density = 1.22541
M = Discharge mass flow during the month in Kgs

Notes:
4) Package Inlet Pressure at PLC shall be used as benchmark for imposition of penalties.
5) Pressure regulator shall not be used to reduce the pressure at the compressor block inlet below 16 Kg/Cm2.
6) In case pipeline pressure at the station itself is less than 16 Kg/Cm2, then the penalty shall be imposed if the package delivery falls below discharge values corresponding to the Compressor's pressure curve, supplied at the time of bid submission only.

11.5.4 Penalty for Non-Performance during Period of Operation & Maintenance

Details of Penalty for non-performance of equipment

c. On normal day (i.e. the day other than the schedule maintenance day):

vii. The Contractor/Bidder has to ensure that the equipment is available for operation for minimum 20 hours per day and on an average the equipment availability has to be 95% in a month.

viii. If the equipment is down for more than 8 hours on any day or availability is less than 95% in a month. Penalty would be applicable as follows:

- Upto 8 hours: Nil
- 8 hours to 16 hours: Rs. 8,000/- per day
- 16 hours to 24 hours: Rs. 12,000/- per day
- More than 24 to 72 hours – 20,000/- per day

ix. In case there is a continuous breakdown beyond 72 hours up to 15 days, 50% of monthly maintenance charges excluding operational Charges will be deducted.

x. In case there is a continuous breakdown beyond 15 days and upto30 Days, 75% of monthly maintenance charges excluding operational Charges will be deducted.

xi. In case there is a continuous breakdown beyond 30 days of a calendar month, 100% of monthly maintenance charges excluding operational Charges will be deducted.

xii. In case of daily availability is 20 hrs. but monthly average availability is below 95%, then penalty @ of Rs. 8,000 per % or part thereof shall be applicable.

d. On schedule maintenance day (excluding periodic major overhaul of compressor/engine):

v. If the equipment is down for beyond the time indicated for the agreed schedule maintenance, the Contractor/Bidder will be penalized as per follows:

- Up to 8 hours: Nil
- 8 hours to 16 hours: Rs. 8,000/- per day
- 16 hours to 24 hours: Rs. 12,000/- per day
- More than 24 to 72 hours: Rs. 20,000/- per day

vi. In case there is a continuous breakdown beyond 72 hours up to 15 days, 50% of monthly maintenance charges excluding operational Charges will be deducted.

vii. In case there is a continuous breakdown beyond 15 days and up to 30 Days, 75% of monthly maintenance charges excluding operational Charges will be deducted.

viii. In case there is a continuous breakdown beyond 30 days of a calendar month, 100% of monthly maintenance charges excluding operational Charges will be deducted.

12.0 PAINTING AND PROTECTION

12.1 SURFACE PREPARATION

a. Rust, rust scale and foreign matter shall be removed fully to ensure that a clean and dry surface is obtained. The minimum acceptable standard for blast cleaning shall be Sa 2-1/2 or equivalent as per Swedish Standard SIS-055900- 1967 or equivalent.

b. Blast cleaning shall not be performed where dust can contaminate surfaces undergoing such cleaning or during humid weather conditions having humidity exceeding 85%.

c. The first coat of primer must be applied by brush on dry surface. This should be done immediately after cleaning.

d. Surface shall be inspected by Purchaser/ third party before application of primer.

12.2 PAINTING (PRIMER & FINISH COAT)

Following primer and finish coats to be applied on the canopy and all structural parts as a minimum:-

a)	Primer	Two component epoxy zinc phosphate primer with minimum volume solids of 59%, an initial cure of 75 minutes at 25 deg. C and a weight of around 2.52 kg/litre.
	No. of Coats:	1
	DFT	75 (micron) µ each
b)	Primer	Two component intermediate coat with epoxy high build MIO (micaceous iron oxide) of minimum volume solids of 80%, an initial cure of 60 minutes at 25 deg. C and a weight of around 2.1 kg/ litre.
	No. of Coats:	1
	DFT	100 micron
c)	Finish Coat:	Acrylic Polyurethane paint
	No. of Coats:	2
	DFT	50 (micron) each coat
	Total DFT	100 µ

Total DFT after application of primer and paint shall be 275 µ (micron) minimum.

12.3 The vendor to ensure that exterior steel surface of equipment and piping painted shall have a fade free life without oxidation of paint surface for at least 5 years in an environment of bright sunlight with an intense UV content.

12.4 The headers of air-cooled exchanger shall be zinc sprayed/painted.

12.5 Packing shall be sufficiently robust to withstand rough handling during ocean shipment & in-land journey. Sling points shall be clearly indicated on crates.

13.0 ERECTION, TESTING AND COMMISSIONING AT SITE

13.1 Bidder shall be responsible for erection, commissioning, performance test, field noise level test and field trial run of all compressor packages at site.

13.2 Bidder shall be liable to pay all local taxes, levies applicable and comply with rules, laws prevailing in concerned state.

14.0 FIELD TRIAL RUN (COMMISSIONING AND COMMERCIAL OPERATION)

Bidder shall conduct a field trial run of each compressor package for minimum 72 hours cumulative or 6 hours continuous duration near the guaranteed points in which satisfactory operation of complete package together with all accessories/auxiliaries controls shall be established for specified operating conditions prior to the start of operation and maintenance period as defined in the contract. During the field trial run, the bidder will be allowed a maximum of three attempts to complete the above-specified test. The Equipment shall be considered commissioned after the successful completion of Field Trial Run. Further Commencement of commercial operation will be intimated by client.
OR
Due to non-availability of the commercial load at CNG station, package will be treated as commissioned after filling of CNG cascades to min.100kg/cm2(g) installed at station.

15.0 SPARE PARTS, SPECIAL TOOLS AND TACKLES

15.1 All spare parts as required, special tools & tackles with toolbox for erection and commissioning and one year operation and maintenance of compressor package shall be supplied by the packager and shall form his scope of supply.

15.2 A brand new separate set of min 10 nos special tools and tackles (such as tool for extraction for hub, key to hold crank shaft for loosing & tightening mech seal/bush, special key to install and uninstall bush for mech seal, piston nut wrench, valve installation tool, rod nut wrench, valve adjusting wrench) as required for Normal maintenance beyond the contractual operation & maintenance period shall be supplied by the packager, which shall form the property of PURCHASER. Special tools & tackles used by bidder in during O&M period shall not be considered as new. Supply shall be before one month of completion of O&M period

16.0 DATA AND DRAWING

a. Drawings and Data shall be furnished in conformity with the Bidder Data Requirements Forms attached with Enquiry Specifications.

b. Bidder shall furnish all the information at the time of bidding as specified in the relevant Bidder Data Requirement (VDR) forms.

c. The data requirement after placement of Fax of intent is indicated in the Bidder Data requirement Forms for the respective equipment, including the number of weeks within which this data is to be provided. Bidder shall confirm that all data as required shall be furnished by him and shall indicate the Bidder's promised data in the columns provided

d. After the placement of FOI, a conference (kick off meeting) will be held at such date

and at such place, as may be mutually agreed upon between the Bidder and the Purchaser. The intent of this conference shall be to discuss / clarify various requirements and finalize the modus operandi for execution of the contract within the scheduled delivery period.

e. Bidder shall furnish the Drawings/Documents for Purchaser's Review / approval as per the Bidder Data Requirement (as specified in the Specifications/ Bidder data requirement forms). The review comments for major and critical drawings (such as system P&ID's, operation philosophy, General Arrangement Drawings, Foundation Drawings, Performance characteristics, etc.) shall be discussed across the table at such date and place as may be mutually agreed between the Purchaser and the Bidder.

17.0 DRAWINGS AND DATA REQUIRED FROM BIDDER

(All drawings & Documents shall be in English Language only and shall be submitted in three sets)

DESCRIPTION		Required with bid	Certified Information Required after Purchaser order/FOA	
A.1	Schedule for furnishing the vendor data			Yes
A.2	A specific statement that CNG compressor package is in strict accordance with data sheet, technical specification & applicable standards, In case of any deviation, specific list with details & reasons for each deviation.	Yes		
A.3	General arrangement (GA) of following equipment indicating battery limit for electric, piping connection & Flange details of piping connection at battery limit. i. Compressor package ii. Air compressor, dryer& receiver iii. CO2 flooding system. iv. Duplex filter v. PRV+SSV		Yes	
A.4	A statement on oil consumption and minimum allowable oil temp.			Yes
A.5	Void			
A.6	Duly filled in experience record program	Yes		
A.7	Foundation plan drawings along with load details of compressor package, Air compressor, dryer, receiver, Duplex filter, CO2 flooding system &PRV+SSV design			Yes
A.8	List of sub-vendors with address / phone / fax no. for all bought out items including electrical & instrumentation items.		Yes	
A.9	Leaflet, catalogues for all items.			Yes

A.10	O & M manual			Yes
B	**Compressor**			
B.1	Data Sheet duly filled in.			Yes
B.2	Catalogue of compressor			Yes
B.3	Void			
B.4	Void			
B.5	Cooler data / drg with thermal & mech. design calculation		Yes	
B.6	Design calculation, GA drgs for pulsation dampner/volume bottles.		Yes	
B.7	Gas , hydraulic oil, lube oil piping & instrument diagram		Yes	
B.8	Void			
B.9	Void		Yes	
B.10	Void			
B.11	Void			
B.12	Void			
B.13	Drg. For testing arrangement & test procedure to be adopted.		Yes	
B.14	Quality Assurance Plan (QAP) and Quality Procedure		Yes	
B.15	Void			
B.16	Void			
B.17	Test records of following		Yes	
	a) Mechanical running		Yes	
	b) Performance test		Yes	
	c) Noise level test		Yes	
B.18	List of special tools & tackles for installation & maintenance		Yes	
B.19	Filled in air cooler data sheet		Yes	
C	**Electric equipment and motors**			
C.1	Performance curves of motor		Yes	
C.2	Technical literature /catalogue, selection charts, nomographs etc. for motors			Yes
C.3	Filled in data sheet of main motor and UV detection system		Yes	
C.4	Control schematics of motors		Yes	
C.5	Performance curves for auxiliaries like fan, pump along with motor		Yes	
C.6	Typical component cross sectional drawing and literature to fully describe the details of offering.		Yes	
C.7	Test procedure of motor		Yes	
C.8	Mill test report of motors		Yes	
C.9	Manufacturer's test report of motors		Yes	

C.10	Stage inspection and test report		Yes	
C.11	Final acceptance testing and performance tested records.		Yes	
C.12	Void			
C.13	Inter connection & wiring diagram		Yes	
D	**INSTRUMENTATION AND ELECTRICALS**			
D.1	Void			
D.2	Instruments and electric motor data sheets		Yes	
D.3	Start-up and shut down write up		Yes	
D.4	Start-up & shut down interlock diagram		Yes	
D.5	Alarm & shut down list with set point		Yes	
D.6	Control panel layout		Yes	
D.7	Termination diagram, panel writing detail		Yes	
D.8	Loop schematic		Yes	
D.9	Inter connecting diagram		Yes	
D.10	Cable schematic		Yes	
D.11	Void			
D.12	Void			
D.13	Test / Inspection certificate		Yes	
D.14	List of relief valves with settings		Yes	
D.15	P & ID of priority panel.		Yes	
D-16	Electrical Load summary	Yes		
D-17	Power required from UPS Supply (230 V AC Single Phase)	Yes		
D-18	Power required from Non UPS Supply (415V TPN)	Yes		
D-19	Combined Speed-Torque Characteristic curve of Motor and Compressor under Star-Delta starting at rated inlet pressure.	Yes		

Note:

a. Drawings/ document as indicated above and which are required to be submitted after placement of order for approval shall be submitted in following sets:

i. 1 CD- of all documents/drawing in editable form (As built drawings only);
ii. 2 sets of prints;
iii. One no licensed CD of software for compressor PLC

On successful award of work, the drawings/documents shall be submitted for approval as per the scope of work.

18.0 OPERATION & MAINTENANCE SERVICES

The date of successful performance test (PT) at site (which shall be conducted within 90 days from the date of successful commissioning of the machine) will be considered as date of start of the annual maintenance contract. However, bidder shall be paid only
50% of O&M charge for operation and maintenance of the compressor from the date of commercial operation upto the date of performance test as part payment against O&M till the capacity and other guaranteed parameters of the package is established through PT. The balance

50% of O&M charge (from the date of commercial operation upto the date of PG test) shall be released to the bidder subsequent to successful PT (ie, after establishing all the guaranteed parameters as per tender) In case the PT is not successful, the balance 50% shall be forfeited in addition to provision of cl. 11.5.4 of this Section. The bidder must follow the 'OPERATION & MAINTENANCE REQUIREMENT' as stated below but not limited to and ensure to provide trouble free services to the satisfaction of the owner

18.1 Accommodation/Transportation/Medical

The bidder shall make his own arrangement for the accommodation of his personnel at respective locations and subsequent transportation arrangement for them from their place of residence to work place or any other place as required and company shall have no obligation in this respect. The company shall not be responsible for providing any medical assistance to the bidder personnel.

18.2 Discipline:

The bidder shall be responsible for the discipline and good behavior of all his personnel deployed in the services contracted out and should any complaint be received against any of his employee, he shall arrange to replace such persons within 24 hours of notice issued by the Engineer-in-Charge. The decision of the Engineer – in-Charge in this matter shall be final and binding on the Bidder.

18.3 Gate pass/identity card

The contract shall arrange to supply / renew identity card to his workforce at his own cost, if so required by the Purchaser for security or for any other reasons. Those

Bidder's personnel shall be required to carry their respective identity cards while on duty and produce on demand.

18.4 Right to get services carried out through other agencies

Nothing contained herein shall restrict Purchaser from accepting similar service from other agencies, at its discretion and at the risk and cost of the Bidder, if the bidder fails to provide the said services any time.

18.5 Sub-letting of contract

Operation & comprehensive Maintenance Services may be sublet after the due permission of purchaser. The bidder may sublet the Operation & Comprehensive Maintenance services to an agency having experience of CNG compressors Operation & Comprehensive Maintenance for min two years. However, complete responsibility including composite bank guarantee shall be furnished by the bidder/supplier. Bank guarantee for O&M shall start from the date of commercial operation by the purchaser which will be as per relevant SCC clause.

18.6 Compliance of laws

The bidder deploying 20(twenty) or more workmen as contract labour shall have to obtain license from appropriate licensing authority, if required. The bidder (which shall include the Contracting firm / company) shall be solely liable to obtain and to abide by all necessary licenses from the

concerned authorities as provided under the various labour laws legislation's including labour license from the competent authority under the Contract Labour ("Regulation & Abolition") Act or similar act applicable to land of law. The Contractor at his own cost shall comply with all statutory regulations required for this Work. All statutory liabilities of payment of ESI/PF or other statutory payments as may be applicable will be borne by the Contractor. The installations where job is to be carried out are live and have hydrocarbon environment. Bidder shall comply with all safety and security rules and regulations and other rules laid down by PURCHASER for its operation. It shall be the duty/responsibility of the bidder to ensure the compliance of fire, safety, security and other operational rules and regulations by his personnel. Disregard to these rules by the Bidder's personnel will lead to the termination of the contract in all respects and shall face penal/legal consequences.

The bidder shall arrange for insurance of all this workers engaged on the job as per the relevant Acts, rules and regulations, etc. In case by virtue of provisions of worker's

compensation Act, or any other law in force. PURCHASER has to pay compensation for a workman employed by the bidder due to any cause whatsoever the amount so paid shall be recovered from the dues payable to the bidder and /or security deposit.

Contract Labour Act & Minimum Wages Act: Contractor shall ensure that all formalities like obtaining all permissions and licenses not limited to but including the contract labour license etc. as required by law are fulfilled by him at appropriate stipulated times. Contractor shall be responsible for all legal liabilities concerning the labour employed by him at site. The Contractor shall comply with all the statues and legislation including but not limited to Payment of wages, Minimum wages etc. relating to labourers /workers. The Contractor shall indemnify and keep purchaser indemnified against all or any of the liabilities that may arise out of its not complying with any of the legislations.

Contractor shall not engage /deploy any child and the persons to be deployed should be physically and mentally fit. The Contractor shall ensure that he does not violate any of the laws of land and shall ensure that he respect and follow the contents of purchaser Values Charter which will be given to successful bidder.

The Bidder has to ensure payment of wages shall be as per minimum wage of the appropriate govt applicable under the minimum wage act.

The officer in charge shall have power to

i. Issue the bidder from time to time during the running of the contract such further instructions as shall be necessary for the purpose of proper and adequate execution of the contract and the bidder shall carry out and bound by the same.

ii. During the currency of this contract, PURCHASER can increase and/or decrease the number of the services / technicians to meet contractual requirements.

iii. Order the bidder to remove or replace any workman whom the company considers incompetent or unsuitable and opinion of the company representative as to the competence of any workman engaged by the bidder shall be final and binding on the Bidder.

18.7 Repatriation and termination

PURCHASER shall reserves the right at any time during the currency of the contract, to terminate it by giving 30 days notice to Bidder, and upon expiry of such notice period the bidder shall vacate the site/office occupied by him immediately.

18.8 Indemnity agreement

Bidder shall exclusively be liable for non- compliance of the provision of any act, laws, rules and regulations having bearing over engagement of workers directly or indirectly for execution of work and the bidder hereby undertake to indemnify the company against all actions, suits, proceedings, claims, damages demands, losses, etc. which may arise under minimum wages act, payment of wages act, workman compensation act, personnel injury (compensation insurance) act ESI Act, Fatal Accident Act, Industrial Dispute Act, Shops and Establishment Act, Employees Provident Fund Act, Family Pension and deposit Linked Insurance Scheme or any other act or statutes not herein specifically mentioned but having direct or indirect application for the persons engaged under this contract. (A certificate to this effect shall be submitted by the bidder immediately on receipt of LOA).

18.9 Details of Penalty for non-performance of Staff

On Non-performance of Staff or deviation from Scope of Work, Client/Owner will intimate supplier / bidder/Contractor in form of 1st Notice. Bidder / supplier/Contractor will confirm the time for resolution.

Resolution time shall be agreed by both parties. If the issue is not resolved within time frame or same issue is repeated, Client/Owner will impose penalty as under:

d) Rs.100/- per Incident Day per personnel/Resource (Deployed by Contractor/Supplier/Bidder) penalty shall be imposed up on failure by the contractor/Supplier/Bidder to provide the necessary PPEs (I Cards, Dress Code/ Uniform / Safety Shoes / Hard hat/Safety Belt) to personnel/Resources and their failure to wear the same as specified by EIC.

e) Rs. 100/- per Incident for the non-compliance found in the log book readings of CNG Compressors.

f) Rs. 500/- per Incident for the untrained CNG Compressor operator is on duty.

18.10 Bidder's responsibility

The bidder shall depute his Supervisor for supervision of the services to receive instructions from Engineer-in-Charge or his representative.

18.11 Employment liability of Bidder

The bidder shall ensure and will be solely responsible for payment of wages and other dues latest by 7thof the following month to the personnel deployed by him in the presence of the Company's representative.

The bidder shall be directly responsible and indemnify the company against all charges, claims, dues etc. arising out of disputes relating to the dues and employment of personnel deployed by him.

The bidder shall indemnify the company against all losses or damages caused to it on account of acts of the personnel deployed by the Bidder. The bidder shall ensure regular and effective supervision of the personnel deployed by him.

The bidder shall be liable for making good all damages/losses arising out of loss or theft of each handled, leakage, pilferage of any office, furniture equipment fitting and fixtures what-so-ever as may be caused directly or indirectly by the engaged persons through him/work carried out by them.

18.12 General

The operation and maintenance services shall be provided in terms of shift pattern on the round the clock basis as mentioned in the tender document.

i) The bidder shall deploy adequate number of technicians / supervisors / Engineers / helpers as well as tools & equipment for smooth and proper operation & maintenance of the compressors supplied in terms of the contract. In case required to meet operational requirements, the bidder shall augment the same as per direction of Engineer–in-Charge.

ii) The bidder is required to carry out all services as mentioned in the Scope of Services and Schedule of Rates on all the 365 days including Sunday and all Holiday & around the clock.

iii) The bidder shall allow weekly rest and daily working hours to his workmen as per the relevant Act/Law/and Rule made thereunder. However, no work shall be left incomplete/unattended on any holiday/weekly rest. Technician/operators provided shall have minimum qualification of ITI. Contract in person or his authorized representative shall provide the services on daily basis to interact with Engineer-in-charge and deployed workman

iv) The work force deployed by the bidder for O&M services at CNG installation shall be of sound relevant technical professional expertise which is otherwise

also essential from the safety point of view of the personnel of the bidder as well as for the installation.

v) Bidder has to ensure the safety of man and machine all the times. Damages of equipment due to negligence will be recovered as per the decision of Engineer- in-Charge, which will be final.

vi) Regarding work completion, the decision of the Engineer-in-Charge will be final and binding.

vii) The bidder shall make his own arrangements to provide all facilities like boarding and transport etc. to his workmen.

viii) All personnel of the bidder entering on work premises shall be properly and neatly dressed and shall wear uniform, badges while working on premises of the company including work sites.

ix) Bidder shall maintain proper record of his working employee's attendance and payment made to them.

x) The Bidder's representative/supervisor shall report daily to the Shift-in-Charge for day to day working.

xi) All the safety rules and regulations prevailing and applicable from time to time at the installations

as directed by PURCHASER will be strictly adhered to by the Bidder.

xii) The rates quoted by the Bidder must be inclusive of all the taxes, duties, services tax, work contract tax and any other levies, Bidder's share of P.F. and insurance charges, Bidder's profit and any other expenditure etc.

xiii) It will be the responsibility of the bidder to pay as per the minimum wages of the appropriate government applicable under the Minimum Wage Act.

xiv) The services shall be provided in terms of shift pattern on the round the clock basis. The bidder is responsible to provide effective and efficient services in all shifts and assure that there is no disruption in the services for want of any resources.

xv) The bidder shall establish a complaint addressable mechanism available 24 hours, seven days a week where complaint regarding non-performance of the compressors in terms of the contract can be lodged. Further, to ensure immediate redressal of complaint round the clock manpower shall be made available, the bidder shall deploy adequate number of technicians/ supervisors / engineers at various site offices in consultation with Engineer-in-Charge to provide trouble free operation & maintenance of the compressors.

xvi) All arrangements for communication from control room to the contract person working on job under the services shall be the responsibility of the Bidder, viz smartphone.

xvii) All the jobs mentioned under scope of services shall be carried out as per sound engineering practices, work procedure documentation, recommendation of the manufacturer and as per the guidelines/direction of engineer-in-charge of authorized representative.

18.13 Operation and Maintenance of compressor packages as per Schedule of Rates

18.13.1 Scope of supply during warranty period:

All spares, consumables, lubricants, lubricating oil, coolant, sealant etc. required for carrying out the Operation and maintenance of the complete compressor package during the warranty period, including periodic, breakdown maintenance for continuous and uninterrupted operation of the compressor packages shall be in scope of the Bidder and shall be kept in stock. If any equipment got fire or broken due to accident the same shall be replaced or rectified by the bidder. Electricity shall be supplied free of cost to the Bidder.

18.13.2 Scope of supply during post warranty period:

All spares, consumables, lubricants, lubricating oil, coolant, sealant etc. required for carrying out the Operation and maintenance of the complete compressor package including major overhauling of compressor & motor during the post warranty period till contract validity, including periodic, breakdown maintenance for continuous and uninterrupted operation of the compressor packages shall be in scope of the Bidder and shall be kept in stock. If any equipment got fire or broken due to accident or in any way motor or compressor's major overhaul is required during breakdown the same shall be replaced or rectified by the bidder, at his own cost. Electricity shall be supplied free of cost to the Bidder.

18.13.3 Scope of services:

i. The Bidder shall have to keep all the spares, consumables, lubricants, coolant, etc required

for carrying out periodic, breakdown, emergency maintenance etc of the

package so as to minimize the down time of the compressor. Non-availability of compressor package for non-availability of spares shall be liable for compensation.

All tools, tackles and fixtures required for carrying out the above maintenance of the compressor shall be in scope of the Bidder. The scope will also include handling equipment like crane, forklift, chain pulley block, etc required during the any maintenance activity.

ii. Any expert services required from principal company or OEM shall be arranged by the bidder or his agent at his own cost. All arrangements like phone, fax, computer, Internet etc required for correspondences with above personnel shall be arranged by the Bidder.

iii. The periodic maintenance required to be done as per OEM recommendation, inclusive of major overhaul maintenance, shall be taken up promptly. The Bidder shall provide the detailed preventative maintenance schedule along with the bid.

d) Estimated down time required for each type of maintenance schedule.

e) List of spares and their quantities required for each type of maintenance schedule per compressor.

f) Type and number of man days required for each type of maintenance schedule per compressor.

The bidder shall plan such maintenance during non-peak hours and in consultation with the Engineer In Charge (EIC) of Purchaser. Any maintenance that needs to be taken up, shall be well planned in advance with due approval of the EIC.

Note:- Major Overhaul Maintenance is defined as:
Highest mentioned maintenance interval in terms of running hours (as per OEM) in which inspection/
testing or removal of crankshaft and crankshaft main bearing is recommended as per OEM.

iv. The Bidder shall use only OEM's certified spares during maintenance. In case, the schedule maintenance of the OEM manual recommends checking and replacing parts like valve spring, valve plates, piston rings etc. after certain time interval, same shall be replaced or used further only on approval from the Purchaser representative. However any untoward consequences for non- replacement of such parts shall be the responsibility of the Bidder.

v. All routine and periodic checks / inspections required to be done as per OEM recommendation shall be done by the Bidder. Instruments required for above inspection like venire caliper, micrometer screw gauge, fill gauges, bore gauge etc shall be in scope of the Bidder and these instruments shall be calibrated every year.

vi. The bidder shall submit a copy of the daily / weekly / fortnightly / monthly / bimonthly / quarterly and yearly performance report to the EIC in both soft and hard form. All stationery including the printed material shall be in scope of the Bidder.

vii. All the maintenance / inspection job carried out by the Bidder shall be recorded and the report of the same shall be jointly signed by Purchaser representative.

viii. The EIC will be final authority to take decision with regards to maintenance or replacement of parts or any disagreement between the Bidder and Purchaser, during the execution of the

contract.

ix. Calibration shall be done from government-approved laboratories and shall be carried out at least 15 days prior to the calibration due date.

x. The Bidder shall keep 1 set of safety relief valves in spare for the purpose of calibration. For total PR quantity of compressor packages.

xi. The Bidder shall carry out retesting of pressure vessels periodically as per Gas Cylinder rules 2016 or
Static & Mobile Pressure Vessels Rules.

xii. The periodic maintenance required to be done as per OEM recommendation shall be taken up promptly. The Bidder shall plan such maintenances during non-peak hours and in consultancy with the Engineer In Charge (EIC) of Purchaser. Any maintenance that needs to be taken up shall be well planned in advance with due approval of the EIC. The scope shall include preparation of maintenance schedule for carrying out the maintenance during the contract period.

xiii. In case, the schedule maintenance of the OEM manual recommends checking and replacing parts like valve spring, valve plates, piston rings etc. after certain time interval, same shall be replaced in the presence of Purchaser representative. If top overhauling of the compressor and prime mover is required as per compressor and prime mover manufacturer's O&M manual recommendation, the same shall be in bidder's scope.

However, all major overhaul required due to breakdown during AMC period shall be in bidder's scope.

xiv. Insurance of free issue items upto 15 days beyond commercial operation by purchaser or p months from the date of supply of equipment at site whichever comes earlier will be in the scope of bidder. The risks that are to be covered under the insurance shall include, but not be limited to the loss or damage in handling, transit, theft, pilferage, riot, civil commotion, weather conditions, accidents of all kinds, fire, war risk etc. After that the purchaser will arrange insurance for fire, war, earthquake, civil commotion, riots and flood. Any other risk over and above will be in the scope of supplier.

19.0 GUARANTEED PARAMETERS (FOR 1200 SCMH & 600 SCMH COMPRESSORS):

19.1 Guaranteed Clause

SL NO	DESCRIPTION	By bidder
1	Compressor capacity as online compressor in SCMH at suction pr.16 kg/cm^2(g), discharge pr. 255 kg/cm^2 and gas inlet temp 30°C.	
2	a. BKW required by compressor at guaranteed parameters	
	b. Transmission efficiency in % (ctef)	
	c. Efficiency of compressor electric motor at operating speed corresponding to guaranteed parameters in % (cmef)	
3	a. BKW required by cooling fan at guaranteed parameters	
	b. Transmission efficiency in % (ftef)	
	c. Efficiency of fan electric motor at operating speed corresponding to guaranteed parameters in % (fmef)	
4	Electric power consumed by compressor package including power absorbed by following auxiliaries along with transmission losses and at guaranteed flow at specified conditions.	
	Lube oil pump motor, Air exchanger fan motor, Cooling water pump motor if required.	
7	Electric power consumed by following auxiliaries shall not be included in the above electric power consumption figure.	
a.	Control panel	
b.	Air compressor motor	
c.	Exhaust fan motor	
d.	Enclosure lighting	
8	Sound level of enclosure (required 70), dBA at 1 meter from enclosure	

19.2 COMP. AT SUCTION PR 17.5 KG/CM^2 (g);

SL NO	DESCRIPTION	By bidder
1	Compressor capacity in SCMH at suction pr.17.5 kg/cm^2(g) discharge pr. 255 kg/cm^2(g) and gas inlet temp 30°C.	
2	a. BKW required by compressor at guaranteed parameters	
	b. Transmission efficiency in % (ctef)	

	c. Efficiency of compressor electric motor at operating speed corresponding to guaranteed parameters in % (cmef)	
3	a. BKW required by cooling fan at guaranteed parameters	
	b. Transmission efficiency in % (ftef)	
	c. Efficiency of fan electric motor at operating speed corresponding to guaranteed parameters in % (fmef)	
4	Electric power consumed by compressor package including power absorbed by following auxiliaries along with transmission losses and at guaranteed flow at specified conditions.	
	Lube oil pump motor, Air exchanger fan motor, Cooling water pump motor if required.	
5	Electric power consumed by following auxiliaries shall not be included in the above electric power consumption figure.	
a	Control panel	
b	Air compressor motor	
c	Exhaust fan motor	
d	Enclosure lighting	
6	Sound level of enclosure (required 70), dBA at 1 meter from enclosure	

19.3 COMP. AT SUCTION PR 19 KG/CM2 (g); CAPACITY BY BIDDER:

SL NO	DESCRIPTION	By bidder
1	Compressor capacity in SCMH at suction pr.19 kg/cm^2(g) discharge pr. 255 kg/cm^2(g) and gas inlet temp 30°C.	
2	a. BKW required by compressor at guaranteed parameters	
	b. Transmission efficiency in % (ctef)	
	c. Efficiency of compressor electric motor at operating speed corresponding to guaranteed parameters in % (cmef)	
3	a. BKW required by cooling fan at guaranteed parameters	
	b. Transmission efficiency in % (ftef)	
	c. Efficiency of fan electric motor at operating speed corresponding to guaranteed parameters in % (fmef)	
4	Electric power consumed by compressor package including power absorbed by following auxiliaries along with transmission losses and at guaranteed flow at specified conditions.	
	Lube oil pump motor, Air exchanger fan motor, Cooling water pump motor if required.	
5	Electric power consumed by following auxiliaries	

	shall not be included in the above electric power consumption figure.	
a	Control panel	
b	Air compressor motor	
c	Exhaust fan motor	
d	Enclosure lighting	
6	Sound level of enclosure (required 70), dBA at 1 meter from enclosure	

Notes:

a) Bidder shall indicate the specific power consumption in KW/SCMH and the power consumption (above defined compressor capacity) in KW/HR as guaranteed value in the offer on the design case gas composition. The guaranteed value of power consumption of electric engine in KW/HR shall be between 142-146 KW/HR corresponding to flow of 1200 SCMH for the given gas and between 72-74 KH/HR corresponding to flow of 600 SCMH for the given gas. Bidder shall not be given any credit/advantage for quoting power consumption below the lower limit. But in case the power consumption quoted by the bidder exceeds the upper limit, the bid will be rejected.

   Therefore, bidders are requested to indicate the power consumption very carefully.
   If any bidder quotes less than 142 KW/HR as power consumption by Electric Motor for running the 1200 SCMH Compressor, then 142 KW/HR will be considered as power consumption by the packager's calculation purpose.
   Similarly, if any bidder quotes less than 72 KW/HR as power consumption by Electric Motor for running the 600 SCMH Compressor, then 72 KW/HR will be considered as power consumption by the packager's calculation purpose.

b) For calculation purpose, power consumption corresponding to guaranteed parameters of 1200 SCMH & 600 SCMH Compressors at 16 kg/cm2(g) suction pressure shall be considered.

20.0 GAS COMPOSITION:

The expected gas composition at City Gas distribution Network is as shown below

Component	**Avg Gas Composition (mol%)**
Nitrogen	0.3505
Methane	94.6591
CO_2	0.5502
Ethane	2.3547
Propane	1.0458
i- Butane	0.2135
n-Butane	0.3223
i-Pentane	0.1427
n-Pentane	0.1414
n-Hexane	0.2199
GCV	9721.00
NCV	8775.00
Specific Gravity	0.59 – 0.625

NOTES:

- O_2 not more than 0.5% mole. Total non-hydrocarbon not more than 2.0%.
- Total S including H_2S not more than 10 ppm by weight.
- H_2S not more than 4 ppm by volume.
- Moisture : No Free water

21.0 CLIMATE

A. HYDERABAD

- Minimum ambient temperature : 5 Deg.C
- Maximum ambient temperature : 50 Deg.C
- Relative Humidity : 94% Max.
- Altitude above mean sea level : 100-601 m
- Wind velocity : NA

B. VIJAYAWADA

- Minimum ambient temperature : 4 Deg.C
- Maximum ambient temperature : 50 Deg.C
- Relative Humidity : 90% Max.
- Altitude above mean sea level : 100-540 m
- Wind velocity : NA

C. KAKINADA

- Minimum ambient temperature : 5 Deg.C
- Maximum ambient temperature : 45 Deg.C
- Relative Humidity : 95% Max., Non condensing
- Altitude above mean sea level : 2-100 m
- Wind velocity : 120 km/hr

22.0 DATA SHEETS OF COMPRESSOR PACKAGES

22.1 Data Sheet of Compressor:

1	**General:** ■ Means required □ Means bidder shall indicate; If not indicated, shall be filled by the bidder	
2	**Project:** City Gas Distribution Network at Hyderabad, Vijayawada & Kakinada	
3	**Owner:** Bhagyanagar gas Limited	
4	**Service:** CNG compressors	
5	**No. Required:** As per MR	
6	**Compressor capacity:** 1200 SCMH /600 SCMH	**Driver:** Electric Motor
	Note: ■ Scope option / information specified by purchaser □ Information required from vendor	
7	☐ **Manufacturer:**	☐**Model No.:**
8	☐**Place of manufacture:**	
9	☐**No. of stages:**	☐**Cylinder arrangement:**

10	☐**Cylinder Lubrication**: Lubricated /Minimum lubricated/Non Lubricated				
11	■ **Driver type:** Motor				
12	☐**Drive:** V belts(Anti-static type) / Direct with coupling				
13	☐**Direction of rotation (Facing driven end):** Clockwise / Counter clockwise				
	■ **Site installation data**				
14	**Ambient temp.(^{0}C):** As indicated in CL 20.0				
15	**Relative Humidity (%):**As indicated in CL 20.0				
16	**Altitude (m):** As indicated in CL 20.0				
17	**Earth quake zone:** III	**Wind velocity (m/s):** As indicated in CL 20.0			
18	**Installation:** Outdoor				
19	■Mounted on a common skid along with driver, enclosed inside an acoustic enclosure				
	■Electrical area Hazard				
20	Class 1, Group D, Division1 as per NEC or Zone 1,Group IIA/IIB as per IS/IEC				
	Applicable Codes and standards				
21	**Compressor:** ISO 13631-2002/API 11P	**Piping:** ANSI/ASME B31.3			
22	**Pressure Vessels:** ASSME Sec VIII, Div-1	**Gas cooler:** API 661			
23	**Oil cooler:** TEMA 'C'/Manufacturer's std. design	**Sound:**70 dBA @ 1m from enclosure			
24	□Aux. Elect. Motors:				
25	**Control panel & instrumentation:** Refer technical specification				
	Utilities data				
26	□Cooling water (Not Available)				
27	☐**Type:** ☐**Supply temperature (^{0}C) :** ☐ **Max. Return temperature:**				
28	☐**Fouling Factor:** ☐**Supply pressure(Kg/cm^2(g):** ☐**Min. return pressure(Kg/cm^2(g):**				
29	☐**Design pressure(Kg/cm^2(g):** ☐**Design temperature(^{o}C):**				
30	☐**Water Flow rates (m^3/hr):**				
	☐**Electricity**				
31	**Auxiliary motors** **V:** **Ph:** **Hz:**				
32	**Oil Heaters (If required)** **V:** **Ph:** **Hz:**				
33	**Solenoid valves** **A.C/D.C:** **V:** **Ph:** **Hz:**				
34	**Instruments** **A.C/D.C:** **V:** **Ph:** **Hz:**				
35	**Local panel-Indi/Alarm/Ann.** **A.C/D.C:** **V:** **Ph:** **Hz:**				
36	**Local panel-Trip circuit** **A.C/D.C:** **V:** **Ph:** **Hz:**				
37	**UPS** **KVA:** **V:** **Ph:** **Hz:**				
	☐**Total utility consumption**				
38	**Cooling water (make up)(m3/hr):**				
39	**Power(Auxiliaries)(kW):**				
40	**Power(Heaters)(kW):**				
	Remarks: Vendor/Bidder should estimate the requirement for all the utilities and indicate the same in tabular form				
	☐**Construction/Design features:**				
41	Nomenclature	Unit	Stage#1	Stage#2	Stage#3
42	Cylinders				
43	No. of cylinders	No.			

44	Single acting(SA)/double acting(SA)				
45	Cylinder Bore/stroke	mm/mm			
46	Rotational speed	RPM			
47	Linear average piston speed	m/sec			
48	Piston displacement	m3/hr			
49	Cylinder liner (yes/No)				
50	Type of cylinder liner: Dry/wet				
51	Clearance pockets: Yes/No				
52	Max. Allowable working pressure, Cylinder	Kg/cm2(g)			
53	Max./Min. Allow. Working Temp., Cylinder	^{o}C			
54	M. A. W. P. Cylinder @ Amb. temp.	Kg/cm2(g)			
55	Safety valve set pressure, cylinder	Kg/cm2(g)			
56	G Helium test pressure, cylinder	Kg/cm2(g)			
57	Hydrostatic test pressure, cylinder	Kg/cm2(g)			
58	Cylinder jacket cooling type as reqd.				
59	Cooling media, cylinder jackets: Water/air				
60	Max. Allow. Working pressure, cyl. Jacket.	Kg/cm2(g)			
61	Hydrostatic test pressure, cylinder jacket	Kg/cm2(g)			
62	Suction nozzle size/ rating/ position				
63	Discharge nozzle size/ rating/ position				
64	Suction valve number				
65	Average gas velocity	m/sec			
66	Discharge valve number				
67	Average gas velocity	m/sec			
68	Type of suction valve				
69	Type of discharge valve				
70	Suction valve unloaders yes/no				
71	Clearance pockets unloaders type				
72	Piston rod diameter	mm			
73	Rod reversal at crosshead pin (min.)	mm			
74	Piston rod run out operating				
75	Max. Allow. Rod load comp.	kg			
76	Tension	kg			
77	Rod load at R.V set comp.	kg			
78	Distance piece/packing				
79	Type of packing				
80	Packing vent connected to ##				

81	Packing cooling				
82	Type of distance piece				
83	Cyl. Side compartment purged				
84	Frame side compartment purged				
85	Distance piece purge gas pressure	Nm3/hr			
86	Distance piece vent to		Safe height	Safe height	Safe height
87	Distance piece hydrostatic test pressure	Kg/cm2(g)			
	## it should be connected to vent header of the package				
	Frame				
88	Replaceable cross head shoes: yes/no				
89	Cross head guide: Integral/separate				
90	Maximum frame rating	kW			
91	Speed- Maximum /minimum	RPM			
	☐**Lubrication system**				
92	Type of lube system			Piping material: CS/SS	
93	Main oil pump driven by:			Auxiliary oil tank:	
94	Stand by oil pump driven by:				
95	Hand operated prelube / priming pump			Oil grade:	
96	Suction strainer:			Lube oil consumtion:	
97	Pressure control valve:			Main pump-make: model: Type: material:	
98	Level sight glass on the crankcase				
99	Type of oil cooler:			Standby pump-make: model: Type: material:	
100	Size of filter				
101	Oil heater(If required):				
102	Electric heater with thermostat (KW):				
103	Thermostatic valve				
104	Type of Cylinder Lubrication:			Lubricator Equipped With :	
105	Lubricator Type: Manzel or Equivalent.			Level sight glass:	
106	Single plunger per feed:			Oil heater electric with thermostat:	
107	Divider blocks type.:			Electric Heater (Kw) (if required)	
108	Lubricator Driven By :			Auxiliary Oil Tank (if required):	
109	Compressor Shaft:			Oil Grade :	
110	Lube oil Electric Motor KW:			Oil System Capacity: (min 30 Hrs.)	
111	All tubing and valves in SS			Oil Consumption. Rate	
112	Double Ball Check valve on each lubrication point				
	□ **Cooling System**				
113	□ **Static filled coolant system for**				
114	□All Stage Cylinders				
115	□Including expansion chamber, Vents, Drains, Level Gauge, Piping, etc.				
116	All Piping prefabricated □ Material				
	□**Atmospheric thermosyphon cooling system for**				
117	□All Stage Cylinders				
118	□Including expansion tank, Vents, Drains, Coolers, and Level & Temp. indicators, Piping, etc.				

119	All Piping prefabricated. □ Material:			
	□**Forced Cooling Water System for**			
120	□All Stage Cylinders			
121	□ Packings □ Oil Coolers □ Gas Coolers			
122	□ Including drains, Vents, flow & temp. Indicators, regulating & Isolation valves, complete piping to provide one			
123	□ Common inlet and one common outlet connections for Purchaser's interface terminated by a flanged block valve			
124	□ Block valve.			
125	□ Each isolatable circuit to be provided with thermal relief valve.			
126	All Piping prefabricated. □ Material			
	☐ **Self-contained, forced circulation, closed circuit Cooling Water System (if reqd.) for**			
127	□All Stage Cylinders			
128	□ Packing □ Oil Coolers □ Gas Coolers			
129	□ Including drains, Vents, flow & temp. Indicators, Temp. Control Valve, Regulating & Isolation valves, complete piping			
130	□ Main circulating pumps with drivers & suction strainers □ Single Coolers			
131	□ Reservoir (Make Up): □ Heater (if required)			
132	□ Pumps, Reservoirs, Coolers etc. to be mounted on a common skid as to make a separate console.			
133	□ Material of piping:			
134	□ Type of coolant:			
135	□ Jacket cooling			
136	□ Gas Piping System:			
	Vendor's Supply Includes:			
137	■ Separator			
138	■ Pulsation suppression equipment as per 'next' page			
139	■ Suction Filter:			
140	■ Strainer on Compressor Suction for start-up			
141	□ Type of Strainer:			
142	■ Relief Valves: on compressor ■ suction ■ Inter-stage ■ on compressor discharge			
143	■ Check Valve on Discharge Line (compressor valve design, and suction line)			
144	■Process Gas Coolers Complete With Manual Drain Valve			
145	■Separators Complete With Automatic Drain Values			
146	■ Process Gas Piping			
147	■Supply starts at inlet flange of CNG PACKAGE			
148	■Terminates after priority panel with isolation valve			
	□ **Materials:**			
149	□ By-Pass Line Piping			
150	□ Between			
151	□ Gas cooler			
152	□ Interconnecting Piping Between Packing Vents, PSV Relief terminating to Vent Recovery System.			
153	□ Interconnecting piping between distance piece terminating to Vent Recovery System up to package B/L			
154	□ Interconnecting piping between Drains terminating as a single point			
155	□ Interconnecting piping between Instrument Air terminating			
156	□ Pulsation Suppression Equipment			
	Stage#	Stage#1	Stage#2	Stage#3
	Suction			
157	Puls. Equipment Required : yes/no			
158	Inlet pressure			

159	Residual peak to peak pulsation %				
160	Inlet nozzle size / rating /position				
161	Discharge nozzle size / rating /position				
162	Design pressure, kg/cm2(a)				
163	Design temperature, kg/cm2(a)				
164	Volume				
165	Material of vessels	SA516 Gr.70	SA516 Gr.70	SA516 Gr.70	
166	Internals				
167	Corrosion allowance, mm	3	3	3	
168	Hydrostatic test pressure, kg/cm2(g)				
	Discharge				
169	Puls. Equipment Required : yes/no				
170	Inlet pressure				
171	Residual peak to peak pulsation %				
172	Inlet nozzle size / rating /position				
173	Discharge nozzle size / rating /position				
174	Design pressure, kg/cm2(a)				
175	Design temperature, kg/cm2(a)				
176	Volume				
177	Material of vessels				
178	Internals				
179	Corrosion allowance, mm				
180	Hydrostatic test pressure, kg/cm2(g)				
181	Design code: ASME Sec. VIII Div.I				
182	■ Automatic Drain Valves For Each Stage suction KOD				
183	□ Capacity Control				
184	■ Start / Stop, based on discharge receiver pressure: Fully Automatic				
185	Unloading for Start-up/Shut down :Automatic Through □ Valve Unloader □ Recycle Valve				
186	■ Interlock against loaded start				
187	■ Automatic Control based on				
188	□ Suction Pressure ■ Discharge Pressure □ Flow Manual Signal				
189	□ Type of Actuator □ Actuation fluid to load □ Actuation fluid to unload				
190	■On Power / Actuation fluid failure : Compressor to □ Load ■ Unload				
191	■ Continuously □ Maximum Hrs.				
192	□ Continuously □ Maximum Hrs.				
193	■ At All other capacity, Compressor should run continuously				
	Vendor's scope Should Include :				
194	■Pilot Devices (pressure / temperature / Flow devices ,Controllers & Switches)				
195	□ Intermediate Devices (Solenoid Valves | Pneumatic Relay / Valves)				
196	■ Actuators				
197	□ Recycle valves				
198	□ Control Logic and System for Complete Capacity Control				
199	■ Inter Connecting Tubing, Piping, Cabling & Wiring				
200	■ Protection against extended unloaded operation (Trip)				
201	□ Valve unloaders are required as such Compressor should start / stop at specified receiver pressures.				
	□**Purchaser's Interface**				
202	Type of Interface (Single Point)	Size	Rating	Face	Position/Location
203	Main Gas Piping Inlet				
204	Main Gas Piping Outlet				

205	Relief Valves discharge				
206	Distance Piece Vent				
207	Packing Vent				
208	C.W. Inlet				
209	C.W. Outlet				
210	Drains				
	MATERIALS				
211	Cylinder materials				
212	Stage	1st stage		2nd stage	3rd stage
213	□Cylinder				
214	□Liner				
215	□ Piston				
216	Piston Rings	PTFE		PTFE	PTFE
217	Rider Rings	PTFE		PTFE	PTFE
218	□ Piston Rod				
219	□ Packings Rings				
220	□ Valve Seats				
221	□ Valve Stops				
222	□Valve Rings / Plates				
223	□Valve Springs				
224	□ Cylinder Head				
	Motion Work Materials:				
225	Item	Material/ASTM Grades			
226	Top Cover				
227	Crankcase				
228	Crankshaft				
229	Connecting Rods				
230	Cross heads				
231	Cross Head Shoes				
232	Cross Head Guide				
233	Main Bearings Type				
234	Cross Head Pin Bearings Type				
235	Connecting Rod Bearings Type				
236	Cross Head Pin Type				
	Notes: Bidder to indicate the material				
237	Each package should be provided with two number drain lines, one from Suction KOD and second drain as common drain line from intermediate and discharge KOD routed to drain vessels through gas recovery vessels				
	CONTROLS & INSTRUMENTATION				
238	■ AC Power On/Off Switch With Indication Lamp				
239	■ Control Power On/Off Switch With Indication Lamp YES				
240	■ Selector Switch A/M Station For L/O Pump Motor				
241	■ Selector Switch A/M Station For CW Pump Motor				
242	■ Emergency Stop Push Button				
243	■ Start Push Button For Air Compressor Motor				
244	■ Emergency Stop Push Button for Main Motor				
245	■ Lamp Test Push Button				
246	■ Alarm / Trip Acknowledge / Reset Push Button				
247	■ Frame Oil Heater ON (Indicating lamp)				
248	■ Lubricator Oil Heater ON (Indicating lamp)				
249	■ Interlock Against Loaded Start				

255	■ Interlock Against Start Without Pre-lubrication		
	Notes :		
	Minimum required indications, alarms & trips are shown herewith. Bidder should provide any additional instrumentation for safe operation.		
	Compressor should start/ stop at pre-determined receiver pressure as specified. Bidder should include in his Scope necessary hardware for the same		
	INSPECTION AND TESTS		
251	Material Composition and Physical Properties Certificates Required For:		
252	■ Cylinder and Liner ■ Piston		
253	■ Crankshaft ■ Connecting Rod		
254	■ Pressure Vessels ■ Heat Exchangers		
255	■ Radiography Examination for components: Pressure Vessels (certificates to be furnished).		
		By bidder	Witnessed
256	■ Mech. Running & string test with job Driver (4 Hours min.)	■	■
257	■ Performance Test at site	■	■
258	■ Functional/Continuity Tests - Control Panel.	■	■
259	■ Field Trial Run ,under Vendor's Supervision (Package)	■	■
260	■ Valve Leak Test	■	□
261	■ Lube Oil Console Run test	■	□
262	■ Closed Circuit C.W. System test	■	□
	During package performance test Required For:		
263	■ Auxiliary Motor & Pumps ■ Safety Relief Valves		
264	■ Safety Switches ■ Solenoid Valves		
265	□ **WEIGHTS**		
266	Overall supply (excluding driver and gear box, if any) Kg. approx.		
267	Maximum erection weight Kg. approx.		
268	Maximum maintenance weight Kg. approx.		
269	Gear Box Kg. approx.		
270	Driver Kg. approx.		
	SCOPE OF SUPPLY		
271	■ Compressor Assembly complete with frame, cylinders, cross head etc.		
272	■ Motion work lubrication system		
273	■ Cylinder and packing lubrication system		
274	■ Cooling system		
275	■ Process Gas system		
276	■ Local instrumentation		
277	■ Local Gauge Board		
278	■ Local Control Panel ■ PLC Panel ■ Human Machine Interface located on skid		
279	■ Main driver		
280	■ Barring Device: ■ Manual ■Electric. ■Pneumatic		
281	■ Flywheel		
282	■ V-Belts with Pulley		
283	■ Couplings		
284	■ Driver Compressor		
285	■ Guards for moving parts		
286	■ Base plate Common for Compressor and Driver		
287	■ Fabricated Steel skid Common for compressor, driver and accessories		
288	■ Ladders and platforms		
289	■ Special Tools - One Set for each package		
290	■ Anchor Bolts for Complete Package		
291	■ Piping supports and brackets : ■ prefabricated for piping in Vendor's Scope		

292	■ Supports For Cylinders & Auxiliaries, Prefabricated & fitted in the Package
293	■ Commissioning Spares, erection and commissioning spares
294	■ Spares as specified in the Job Specification
295	■ Vendor Data as specified
296	NOTE : Refer check list for scope of supply

22.2 Data sheet of Heat Exchangers to be submitted for Compressor's package:

1	**General:** ■ Means required □ Means bidder shall indicate; If not indicated, shall be filled by the bidder
2	**Project:** City Gas Distribution Network, Hyderabad, Vijayawada & Kakinada
3	**Owner:** Bhagyanagar gas Limited **Site:** Hyderabad, Vijayawada & Kakinada geographical area
4	**Service:** Intercooler / After cooler for compressor package
5	□**No. Required:**
6	NOTE: ■SCOPE OPTION / INFORMATION SPECIFIED BY PURCHASER □ INFORMATION REQUIRED FROM VENDOR.
7	□Manufacturer □ Type: forced draft/Induced draft
8	□Bundle size: m x m x m □ Bundles/section: □Number of units:
9	□ Bundles/unit: □ In parallel/series: □Section size:
10	□ Surface area/Bundle:m2 □Bare tube: m2 □Section/unit:
11	□ Surface area/unit:m2 □Bare tube: m2 □Plot area/unit:
12	**Performance (of one unit)**
13	□Heat exchanged: kcal/hr □MTD(Corrected):°C
14	□Transfer rate: kcal/hr m2 °C □ (Finned surface): □ (Bare surface):
15	■**Tube side**
16	■Fluid circulated: **Gas** Gravity: Liquid API SG @ 15.4EC
17	■Total entering gas ,kg/hr: As per TS ■Enthalpy/Latent heat kcal/kg: As per gas composition
18	□OperaΘng temperature(°C) In: Out: Fouling resistance, hr m2 °C/kcal:
19	□OperaΘng pressure passes/bundle, kg/cm^2
20	**Air side**
21	■ Temperature (°C) In: 45 **°C** □Out: ■ Altitude,m: As indicated in CL 20.0
22	□Total flow/unit, kg/hr □ Static pressure, kg/cm2
23	□Quantity/fan, kg/hr □ Power/fan, kW
24	□Face velocity, m/sec □ Power/unit, kW
25	**Construction (Each bundle)**
26	□Design pressure, kg/cm2g □ Test pressure, kg/cm2g: □ Design temperature, °C:
27	□Code requirements
28	□Type of tubing: □Tube material: ■Fin material: Al
29	□Tube Bare tubes(nos.): □No. of rows, O.D: □BWG/Thk.: □Length:
30	□Fins: spacing/inch. O.D: □Root dia.: □Thickness.:
31	■Header type: Plug/cover □No. of splits: □Material
32	□Plugs/gaskets ■Side frame: C.S. Inside Zinc protected
33	□ Nozzles □ In : □ Out :
34	□ Coupling □ Vent: □ Drain :
35	**CONSTRUCTION (Each section)**
36	■Structure CS □ Sec. /Gr. No.: □ Design Wind Load : kgf/m
37	■ Plenum Chamber CS inside Zinc Protected Type :
38	□ Fans No. Dia. RPM Mfr.
39	□ Blades Material : No./Fan Pitch Angle(Design) :

40	□ Hubs Material: Pitch: Auto / Adjustable (No.)
41	□ Louvers Material : Type : Mfr.
42	□ Weights kg Each Section(Dry) : Full of Water:
43	□ Each Bundle (Dry) : Full of Water:
44	■ APPLICABLE SPECIFICATIONS API Standard 661
45	■ REMARKS 1. Air coolers should be designed for 10% excess capacity than required normally.
46	■ Exchanger should be designed with air side temperature of 44°C.
47	■ Separate data sheet should be filled by the bidder for each service i.e. Inter cooler and After cooler

22.3 Data Sheet of MAIN MOTOR: (if not indicated shall be filled by the bidder)

1	Project name:	City gas distribution network, Hyderabad, Vijayawada & Kakinada
2	Driven equipment	Compressor
3	Tag No. / Equipment No.	
4	Duty	
5	Manufacturer	
6	Type	THREE PHASE, SQUIRREL CAGE INDUCTION MOTOR.
7	Frame designation	
8	Output _____KW	
9	Voltage _____VOLT	415 V+/ - 10%
10	Full load current_____AMP	
11	Starting current with star delta starting AMP (soft starter)	
12	Full load speed _____ RPM	
13	Enclosure	TEFC/FLAMEPROOF/IP55 AS PER IS:4691:1985, IS :12615:2011, IS: 2148
14	Mounting	
15	Insulation Class	F' - Temp. rise limited to Class - 'B'
16	Ambient temperature _____°C	
17	Temp. Rise by resistance _____ °C	
18	Applicable Code	
19	Full load torque _____ Kg-m	
20	Starting torque _____FLT	
21	Efficiency at _____100% Load	
	_____75% Load	
	_____50% Load	
22	Rotation viewed from DE	
23	Bearing type No.	
24	Type of Lubrication	
25	Coupling / pulley	DIRECT / FLEXIBLE
26	Net weight (approximate) _____kg	
27	Cable size / type _____mm sq.	
28	Phase / connection / No. of terminal	
29	Frequency _____Hz.	50 Hz + / - 5%
30	No. of poles _____	
31	Locked rotor current_____%FLC	
32	LR withstand time (HOT) _____Sec	
	(COLD) ----------Sec	
33	Stator / rotor time constant _____Min	
34	Power factor at - 100% Load	
	- 75% Load	
	- 50% Load	
35	Break down or pull out torque ___%FLT	
36	GD Sq. of load _____Kg-mP ^{2}	

37	GD Sq. of motor _____Kg-mP ^{2}	
38	Starting time at 100% / 80% V with star delta starting (Sec)	
39	No. of starts – Hot / Cold	4
40	Vibration Level / Noise Level	As per IS12065 / IS12075
41	Speed – Torque characteristics curve	

Please submit data sheet for other electric motors included in the compressor package.

22.4 DATA SHEET OF AIR COMPRESSOR MOTOR:

(if not indicated shall be filled by the bidder)

1	Project name:	City gas distribution network, Hyderabad, Vijayawada & Kakinada
2	Driven equipment	Air Compressor
3	Tag No. / Equipment No.	
4	Duty	
5	Manufacturer	
6	Motor Duty & Type	
7	Frame Size/Mounting	
8	Output _____KW	
9	Voltage _____VOLT	415 V+/ - 10%
10	Full load current_____AMP	
11	Starting current with star delta starting AMP	
12	Full load speed _____ RPM	
13	Enclosure	TEFC/FLAMEPROOF/IP55 AS PER IS:4691:1985, IS :12615:2011, IS: 2148
14	Mounting	
15	Insulation Class	F' - Temp. rise limited to Class - 'B'
16	Ambient temperature _____°C	
17	Temp. Rise by resistance _____ °C	
18	Applicable Code	
19	Full load torque _____ Kg-m	
20	Starting torque _____FLT	
21	Efficiency at _____100% Load	
	_____75% Load	
	_____50% Load	
22	Rotation viewed from DE	
23	Bearing type No.	
24	Type of Lubrication	
25	Coupling / pulley	DIRECT / FLEXIBLE
26	Net weight (approximate) _____kg	
27	Cable size / type _____mm sq.	
28	Phase / connection / No. of terminal	
29	Frequency _____Hz.	50 Hz + / - 5%
30	No. of poles _____	
31	Locked rotor current_____%FLC	

32	LR withstand time (HOT) _____Sec	
	(COLD) ----------Sec	
33	Stator / rotor time constant _____Min	
34	Power factor at - 100% Load	
	- 75% Load	
	- 50% Load	
35	Break down or pull out torque ___%FLT	
36	Space heaters _____WATT / VOLT	
37	Vibration Level / Noise Level	As per IS12065 / IS12075

22.5 DATA SHEET OF GAS DETECTION SYSTEM

1	**GENERAL: ■ Means required □ Means bidder shall indicate; if not indicated shall be Filled by the bidder**	
2	**Project:** City Gas Distribution Network, Hyderabad, Vijayawada & Kakinada	
3	**Owner**: Bhagyanagar gas Limited	Site: **Hyderabad, Vijayawada & Kakinada Geographical Area**
4	**Equipment:** Gas detection For CNG stations	
5	**No.:**	Gas detection type:
	Note: ■ Scope option / information specified by purchaser □ Information required from vendor	
6	□ Manufacturer:	□ Model No.:
7	Signal transmission	
8	□**Analog: Transmission by 3 core shielded cable**	
9	□ **Measurement control: 4mA to 20mA**	
10	□ **Sensor drifts below zero:**	
11	□ **Measuring range exceeded:**	
12	□ **Transmitter fault:**	
13	□ **Maintenance signal:**	
14	□ **Hart compatible:**	
	■SITE /ENVIRONMENTAL DATA	
15	■ **Site installation data: Hyderabad, Vijayawada & Kakinada Geographical Area**	
16	**Ambient temp.(°C):** As indicated in CL 20.0	
17	**Relative Humidity (%):**As indicated in CL 20.0	
18	**Altitude (m):** As indicated in CL 20.0	
19	**Earth quake zone:** III, **Wind velocity (m/s):** As indicated in CL 20.0	
20	■Electrical area Hazard	
21	Class 1, Group D, Division1 as per NEC or Zone 1,Group IIA/IIB as per IS/IEC	
22	■ Applicable codes and standards	
23	■ Gas detection approvals: **CENELEC :Exd IIC 6**	■ **UL, CSA: Class 1, Div 1, Groups B,C,D**
24	**Voltage of supply**	
25	□ Operating voltage: A.C/D.C: V: Ph:	
26	□ In-Rush current: A.C/D.C	
27	□ Power input A.C/D.C	
28	■ **Physical specifications**	

29	□ Enclosure: **Nema 4+7 (IP65)**
30	□ Size
31	□ Weight
32	■ Inspection and tests
33	□ Physical Tests on site:
34	Remarks

22.6 Data Sheet- UV Fire Detection System

1	**GENERAL: ■ Means required □ Means bidder shall indicate; if not indicated shall be Filled by the** bidder				
2	**PROJECT:** CITY GAS DISTRIBUTION NETWORK				
3	OWNER:**M/S BGL**		SITE: **Hyderabad, Vijayawada & Kakinada**		
4	EQUIPMENT: **UV FIRE DETECTION FOR CNG STATIONS**				
5	**NO.**		FIRE DETECTION TYPE:		
6	NOTE: ■ SCOPE OPTION / INFORMATION SPECIFIED BY PURCHASER □ INFORMATION REQUIRED FROM VENDOR.				
7	□ MANUFACTURER:		□ MODEL NO.:		
8	□ **WAVE LENGTHS:**		■ **TYPICAL RESPONSE TIME: < 3 SEC @ 50FT**		
9	□ **FIELD OF VIEW:**		□ **MINIMUM SENSOR RESPONSE TIME:**		
10	□ **SENSITIVITY**		□ **MAINTENACE SIGNAL:**		
11	■ CLASSIFICATION: **CLASS I, DIV 1, GROUPS B, C & D: Eexd IIC, T5, IP66**		■ **CLASS II, GROUP E,F & G** CLASS III, TYPE 4X		
12	■ APPROVALS: CSA, FM, ATEX, CENELEC, CE MARKING				
13	■ **ENVIRONMENTAL SPECIFICATIONS**				
14	■ OPERATING TEMPERATURE RANGE: -40 (0C) **to** 85 (0C)				
15	■ STORAGE TEMPERATURE RANGE: -50 (0C) to 85 (0C)				
16	■ OPERATING HUMIDITY RANGE: 0% TO 100% RH NON-CON-DENSING				
17	■ ALTITUDE (M):				
18	■ EARTH QUAKE ZONE III				
19	■ INSTALLATION: ■ INDOOR				
■ ELECTRICAL SPECIFICATION:					
20	■ INPUT POWER: 20 - 36 VDC, 24 VDC @ 150Ma max.			□ COPM FAULT	
21	■ANALOG SIGNAL: 4-20mA (600 Ohms Max.)			□ READY SIGNAL	
22	□ FAULT SIGNAL: 0Ma			□ UV SIGNAL:	
23	□ IR SIGNAL:			□ WARN SIGNAL:	
24	□ ALARM SIGNAL:			□ BAUD RATE:	
25	■ RELAY CONTACT RATING: 8A, 255VAC, 8A @ 24VDC			□ RS-485 OUTPUT:	
26	■ RFI/EMI PROTECTION: COMPLIES WITH EN50081- 2			□ STATUS INDICATOR:	
	□ FAULT MONITORING:				
■ MECHANICAL SPECIFICATION:					
28	■ HOUSING:			■ LENGTH:	
29	■ **DIAMETER:**			■ **MOUNTING:**	
30	■ **CABLE ENTRY:**			■ **WEIGHT:**	
SCOPE OF SUPPLY					
31	■ **UV FIRE DETCTION SENSORS COMPLETE:**				
32	■ **DATA SHEET COMPLETED**				
33	REMARKS:				

22.7 DATA SHEET OF CORIOLIS MASS FLOW METER (SUCTION)

Sl. No.	PARAMETER	REQUIREMENT
1.	Fluid	Compressed Natural Gas
2.	Measuring Principle	Coriolis Principle
3.	Operating Pressure	40 (max.) bars ,19 (Normal) bars, 8 (min.) bars (Will be confirm during detailed engineering.
4.	Molecular Weight	17 – 22
5.	Ambient Temperature	0 – 60 ^{O}C
6.	Hazardous area classification	Class I, Div I, Gas Group D as per NEC or Zone1,Group IIA/ IIB as per
7.	Range of operation	1100-1300 SCM/HR
		850-1000 KG/HR
8.	Accuracy	± 0.5% of span (over the whole operating range on gas)
9.	Rangeabiliy for specified accuracy (Min.)	50:1
10.	Line Size	2.0 " (Flange type), 300# WNRF (Material: 316 L)
11.	Pressure drop at max.	< 0.2 Kg/cm^{2}g
12	Repeatability	± 0.25% or better
13.	Material - Tube	SS 316 or Better
14.	End Connection	To suit the line size(2.0") , Flange connections
15	Power supply (nominal)	230±10% V, 50±2 Hz, 1 Φ
16	Outputs (Active)	
16.1.	4 – 20 mA dc	Reqd.
16.2.	Frequency	Reqd.
16.3.	RS 485	Reqd.
17	Outputs Information	
17.1	Mass Flow rate	Reqd.
17.2	Mass totalizer, non-resettable	Reqd.
17.3	Temperature	Reqd.
17.4	Integral Display	Display all outputs with specified accuracy, programmable and sequential with password protection, **Touch screen or touch keypad type**
18	Communication	**MODBUS with RS 485**
19	Mounting	Field mounting
20	Certification	Hazardous area compatibility, Weather proof certification i.e. IP 67, Material Test, Manufacturer's certification, Custody Transfer approval, AGA 11 Conformance certification and Calibration Certificate on water and Natural Gas from accredited test labs with traceability acceptable internationally.

22.8 DATA SHEET OF CORIOLIS MASS FLOW METER (DISCHARGE)

Sl. No.	PARAMETER	REQUIREMENT
1	Fluid	Compressed Natural Gas
2	Measuring Principle	Coriolis Principle
3	Operating Pressure	**300 (max.) bars ,255 (Normal) bars, 100 (min.) bars**
4	Molecular Weight	17 – 22
5	Ambient Temperature	0 – 60 ^{O}C
6.	Hazardous area classification	Class I, Div I, Gas Group D as per NEC or Zone1,Group IIA/ IIB as per IS/IEC specifications
7.	Range of operation	1100-1300 SCM/HR
		850-1100 KG/HR
8.	Accuracy	± 0.5% of span (over the whole operating range on gas)
9.	Rangeabiliy for specified accuracy (Min.)	50:1
10	Line Size	0.5 "(TUBE END)
11	Pressure drop at max. flow	< 0.2 Kg/cm^{2}g
1	Repeatability	± 0.25% or better
13	Material - Tube	SS 316 or Better
14	End Connection	To suit the line size (0.5") ,
1	Power supply (nominal)	230±10% V, 50±2 Hz, 1 Φ
1	Outputs (Active)	
16.1.	4 – 20 mA dc	Reqd.
16.2.	Frequency	Reqd.
16.3.	RS 485	Reqd.
1	Outputs Information	
17.1	Mass Flow rate	Reqd.
17.2	Mass totalizer, non-resettable	Reqd.
17.3	Temperature	Reqd.
17.4	Integral Display	Display all outputs with specified accuracy, programmable and sequential with password protection, Touch screen or touch keypad type
18	Communication	**MODBUS with RS485**
19	Mounting	Field mounting
20	Certification	Hazardous area compatibility, Weather proof certification i.e. IP -67, Material Test, Manufacturer's certification, Custody Transfer approval, AGA 11 Conformance certification and Calibration Certificate on water and Natural Gas from accredited test labs with traceability acceptable internationally.

22.9 DATA SHEET OF THERMAL MASS FLOW METER (TO MEASURE VENT LOSS)

SR. NO.	PARAMETER	REQUIREMENT
1	Fluid	Natural Gas
2	Measuring Principle	Thermal

3	Operating Pressure	50 mbar g
4	Molar Mass	17 -22
5	Ambient Temperature	0-60°C
6	Hazardous area classification	Class I, div I Gas Group D as per NEC or Zone 1, Group IIA / IIB as per IS / IEC Specification
7	Range of Operation	0.6 - 16 SCM/Hr 0.5 - 12 Kg / Hr
8	Measured Error Mass	± 1.5% of indicated flow accepted (over the operating range of 2-12 Kg/Hr on gas)
9	Meter Size	0.5"
10	Pressure drop at max. flow	2 mbar max.
11	Repeatability	± 0.5% or better
12	Material Tube	SS 316 or better
13	End connection	To suit the line size, flange Connections
14	Power Supply (nominal)	230 ± 10% V, 45-65 Hz
15	Output (Active)	
16	RS 485	Required
17	Outputs Information	
17.1	Mass Flow Rate	Required
17.2	Mass Totalizer, non - resettable	Required
17.3	Temperature	Required over MODBUS
17.4	Integral Display	Display all outputs with specified accuracy, programmable and sequential with password protection. Touch Screen or Touch Keypad Type
17.5	Density	Required
17.6	Pressure	Required
17.7	Volume flow rate	Field configurable with password protection for molecular weight range: 17 to 22
17.8	Volume flow totalizer	Field configurable with password protection for molecular weight range: 17 to 22
17.9	Periodic mass & totalizer, non-resettable	Four (one each monthly, daily, fortnightly and one for configurable period)
18.	Programmer	Calibration software, perpetual licence with portable hardware platform complete with all connectors, power adopter, batteries. System should be suitable for effecting calibration changes, configuring the flow meter / transmitter, storing test result, plotting and storing graphs, diagnostics, password protection etc. Carrying case, easily installable in the field for calibration set up
19.	Communication	MODBUS with RS 485
20.	Mounting	Field mounting, (Vertical)
21.	Certification	CCOE/PESO

23.0 EXPERIENCE RECORD PROGRAM OF PACKAGING

Sl. No.	Description	INFORMATION OF OFFERED COMPRESSOR	INFORMATION OF EXISTING COMPRESSOR
1	REQUIREMENT AS PER TENDER		

	1) Status of bidder (Indicate packager or agent of packager)			
	2) In case the Bidder is agent submit the agreement of agent ship/dealership with packager			
2	**COMPRESSOR**			
	Name of compressor manufacturer			
	Place of compressor manufacturer			
	Compressor model			
	Anticipated Life in running hours			
	Compressor maximum frame BKW			
	Compressor operating RPM			
	Compressor max design RPM			
	Comp Manufacturing code preferably ISO 13631/API-618 11P			
	Lubricated or non-lubricated			
	Nos of stages			
	Max stage temperature deg cen (150 deg cen)			
	Compressor Operating RPM (max RPM-1500)			
	Piston speed (4.5 m/s lub, 4m/s non lub)			
	Compressor maximum vibrations at cylinders and at frame shall not exceed 10 mm /sec. And 5 mm/s respectively unfiltered peak velocity			
	Material for all stages			
	Cylinder			
	Piston Rings			
	Rider Rings			
	Piston Rod			
	Valve (Rings / Plates/ spring)			
3	**PERFORMANCE OF COMPRESSOR**			
CASE-L	Performance of compressor at 16 kg/cm2(g) suction pr, 255 kg/cm2 (g)discharge pr and 30 deg c suction temperature			
CASE-G	Performance of compressor at 17.5 kg/cm2(g) suction pr, 255 kg/cm2 (g)discharge pr and 30 deg c suction temp			
CASE-H	Performance of compressor at 19 kg/cm2(g) suction pr, 255 kg/cm2(g) discharge pr and 30 deg c suction temp			
	a) Capacity SCMH	**CASE-L**		
		CASE-G		
		CASE-H		
	b) BKW required by compressor including	**CASE-L**		
		CASE-G		

	compressor's lube oil pump BKW	**CASE-H**		
	c) BKW required by compressor including compressor's lube oil pump BKW **at RV set pr**	**CASE-L**		
		CASE-G		
		CASE-H		
	d) KW rating of main compressor motor, 4 starts per hr, with 10% over rating w.r.t max of b+ "transmission losses" above			
	e) Gas cooler (heat exchanger) fans; nos required (W+S)			
	f) Power required for all fans including transmission losses in KW @ 10% over rating	**CASE-L**		
		CASE-G		
		CASE-H		
	II) Ventilation fans for enclosure No of fans Type of fans (induced or forced draft) Power required for all ventilation fans in KW			
	Piston rod and cross head pin loading at any specified operating condition including the relief valve set condition shall not exceed 80% of the maximum design rod load of the offered compressor.			
	----Piston rod : max Design			
	----Piston rod : calculated at safety set pr condition			
	----Max cross head pin loading: Design			
	----Cross head pin loading :calculated at safety set pr condition			
4	**Electric motor**			
a)	**Main compressor drive motor**			
	Make and model			
	Name plate rating in KW			
	RPM of motor			
	Site rating after duration, KW			
b)	**Ventilation fan motor**			
	Make and model			
	Nos provided (W+S)			
	Name plate rating in KW			
	RPM of motor			
	Site rating after duration, KW			
c)	**Cooler fan motor**			
	Make and model			
	Nos provided (W+S)			
	Name plate rating in KW			
	RPM of motor			
	Site rating after duration, KW			

d)	**Coolant pump motor**		
	Make and model		
	Nos provided (W+S)		
	Name plate rating in KW		
	RPM of motor		
	Site rating after duration, KW		
e)	**Any other motor**		
	Make and model		
	Nos provided (W+S)		
	Name plate rating in KW		
	RPM of motor		
	Site rating after duration, KW		
5	**PACKAGE**		
	Name and Address of packager		
	Place of packaging (address)		
	Name of enclosure manufacturer		
	Place of enclosure manufacturing		
	Sound level at 1 m distance from package in db(A) - 70		
	Make & model LEL detectors – 2 nos		
	Make & model fire detectors – 2 nos		
	CO2 flooding system (2 cylinders each of 100% capacity required)		
	Quantity of CO2 in each cylinder in Kg		
	Volume of enclosure in m3		
	Nos of explosion proof tube light in enclosure min 3 nos.		
	Coupling Direct / V-belt		
	Separators between inter stage of compressor		
6	**Gas inlet train**		
	WNRF, Flanged connection; outside canopy		
	Inlet relief valve		
	Inlet gas pressure gauge		
	Non return valve		
	Inlet filter of 5 micron size		
	Inlet twin filter		
	suction line strainer after main filter		
	Inlet manual isolation valve		
	Inlet automatic isolation valve		
7	**Gas recovery system**		
	Gas recovery system with pr relief valve, pr regulator, pr gauge, drainage system		
8	**Gas delivery system**		
	High pr piping with SS 316 tubing, compression fittings, NRV.		
	Coalescent final separator		
	Coalescent super fine filter with CE mark for removal of liquid (e.g. water & oil) and solid		

	particles down to 0.1 microns out of compressed natural gas. Residual Oil Contents shall be less than 1 PPM.		
	Discharge isolation valve		
	PLC based Priority panel with SS 316 double ferrule compression fillings, tubing, full bore ball valve. Indicate nos of banks		
	Mass flow meter: Coriolis principle; interfaced with PLC; head mounted local display to indicate flow rate (Kg/hr), cumulative gas compressed (in Kgs) etc.; inbuilt totaliser non-volatile & non- resettable type ; suitable for hazardous area classification ; One at compressor discharge One at compressor inlet		
	Final gas outlet connection from priority panel 3/4" (1" for bus) pipe OD, SS double ferrule compression fittings.		
9	**ESD system**		
10	**Volume bottles / dampers at each compressor stage of compressor.**		
	Manual isolation valve		
	Automatic valves		
11	**Heat exchanger**		
	Code of construction preferably API 661		
	Tube material		
12	Piping between stages shall be continuous with flange and welded connection		
13	Other tubing shall be SS as defined in TS		
14	Gas recovery vessel provided		
15	Area classification; "Class 1, Group D, Division 1 as per NEC" OR "Zone 1, Group IIA /IIB as per IS/ IEC"		
16	The size of the complete package		
17	Chain pulley block and beam for chain pulley block		
18	Acoustic enclosure for electric motor and compressor		
19	Confirm that instrumentation will be supplied as per tender		
20	Man-machine interfacing unit (MMI), PC color printer in control room		
21	String test at shop		
22	Field trial run		
23	Electric power consumed by compressor package including power absorbed by lube oil pump motor, cooling water pump for comp along with transmission losses but excluding power absorbed by air compressor motor, exhaust fan motor, control panel, heat exchanger fan & enclosure lighting at guaranteed flow and at specified conditions.		
24	Confirm no deviation w.r.t tender		

25	Max turn over the bidder/manufacturer or packager during any of the last three financial years.		
26	**Other information of compressor package :**		
	a) Year and month of packaging the compressor package		
	b) Name and address of user with FAX no, Phone no, E-mail address		
	c) Nos of hours the compressor have clocked on bid due date. (Enclose certificate from user)		
	d) Documentary evidence that the bidder / manufacturer or packager having the capability and facilities (i.e. shop, manpower, testing facility etc.) for manufacturing / packaging five packages in a year.		
	e) Whether the bidder having office set up in India equipped with trained and experienced technical manpower for the operation and maintenance services.		

24.0 LIST OF INSTRUMENTATION & CONTROLS FOR COMPRESSOR

		INDICATION		ANNUNCIATION & PRE ALARM		TRIP	
Sl No.	**Description**	**GUAGE–LOCAL GUAGE BOARD**	**INDICATOR LOCAL PANEL (PLC) DISPLAY**	**LOW LOCAL PANEL DISPLAY**	**HIGL LOCAL PANEL-DISPLAY (PLC)**	**LOW –LOCAL PANEL - PLC-DISPLAY**	**HIGH LOCAL PANEL PLC- DISPLAY**
1	Frame Oil Sump/Reservoir Level	■ yes				■ yes, switch	
2	Main L/O Pump Disch. Pr (supply header).	■ yes	■ yes	■ yes		■ yes	
3	Oil Flow						
4	Oil Pressure at Main Bearing						
5	Supply Header Temp.						
6	Oil cooler Oil Inlet Temp.						
7	Stand by Pump Start						
8	Compressor Main bearing metal Temp.						

9	Cylinder & Packing Oil						
10	Lubricator Oil Level	■yes local (Sight glass)					
11	Lubricator Oil no Flow						
12	Lubricator Failure					■ yes	
13	Aux. Oil						
14	Lub. Oil Supply Pr.						
15	Lub. Oil return						
16	Elec. Motor bearing metal temp.						
17	Coolant System						
18	Each cylinder CW outlet temp.						
19	Inter/After/Oil Cooler CW outlet temp.						
20	CW Supply header flow						
21	Sight Flow CW return each cylinder, Cooler & Header						
22	For Closed Circuit Cooling						
23	Coolant main pump disch. Pr.						
24	Coolant standby pump disch. Pr.						
25	Coolant stand by pump start						
26	Coolant supply header Pr.						
27	Coolant supply header temp						
28	Coolant cooler Outlet Temp.						
29	Coolant reservoir Level						
30	Cylinder Coolant Outlet temp.						
31	For Static/Thermo-siphon System						
32	Cylinder Coolant Outlet temp.						
33	Diff. Pr. Across packing coolant filter						
34	**Process Gas System**						

35	Temperature before twin filter at suction	■ yes	■ yes				
36	Pressure & Temperature before twin filter at suction*	■yes	■yes	■yes	■yes	■yes	■yes
37	1^{st}, 2^{nd} and 3^{rd} tage Outlet s Pressure	■ yes	■ yes		■ yes		■ yes
38	Each stage Outlet temp.	■ yes	■ yes		■ yes		■ yes
39	After Cooler Gas Outlet temp.	■ yes	■ yes		■ yes		■ yes
40	Cylinder Packing Vent Pressure						
41	Final Disch Press. after coalescent filter *	■ yes	■ yes		■ yes		■ yes
42	Blow Down vessel level if required						
43	Piston Rod Drop Indicator						
44	Distance piece diff. Purge pressure						
45	Common process parameters						
46	Common machine parameters						
47	Blow Down vessel Pressure	■ yes					
48	Vibration on comp.						■ yes switch
49	Min electric motor speed.						
50	Main motor fails to start					■ yes	
51	Electric power consumption indication	■ yes	■ yes				
52	motor winding temperature : pt-100						■ yes
53	Temp before and after Air cooler	■ yes					

*** Pressure transmitter shall be of smart type with LCD display**

25.0 QUALITY ASSURANCE PLAN AND CONTROL:

The supplier shall perform all test and inspection as per tender and as per this quality assurance plan.

CUSTOMER'S REF ..... : REF ..... ….. : COMPRESSOR MODEL ..... :

SI No.	Description	D	R	TW	W	
1.	**Compressor** (also refer note 4)					
	Material TC for: crank shaft, connecting rods, cylinder, liner, piston	Yes	Yes	-	-	
	Hydro test of cylinder heads	Yes	Yes	-	-	
	Ultrasonic test of – crank shaft, connecting rod. piston rod. (refer note: 1) (MFR's compliance report/ certificate)	Yes	Yes	-	-	
	End clearance of the cylinders, piston rod run out	Yes	Yes	-	-	
	No load mechanical run test as per manufacturers standard (4 hours test at packager's end) – Manufacturer's compliance report	Yes	Yes	-		
	Manufacturer's compliance report for Strip check internal inspection after "NLMRT" of all compressors –Refer note: 2	Yes	Yes	-	-	
2.	**Motor**					
	Manufacturer's compliance report – **Note 3 & 4**	Yes	Yes			
	Type test certificate by CMRI	Yes	Yes			
3.	**Pressure vessels (at sub-vendor works)**					
	Material test certificates for RAW Material	Yes	Yes			
	Dimension and Visual Inspection Report as per drawing	Yes	Yes			
	Radiography of pressure vessels as applicable	Yes	Yes	-	-	
	Hydro test of pressure vessels	Yes	Yes	Yes	-	
	Final painting and cleaning	Yes	Yes	-	-	
4.	**Heat Exchangers (at sub-vendor works)**					
	WPS / PQR – Welder Qualification	Yes	Yes	-	-	
	Material test certificates for raw material (pressure parts)	Yes	Yes	-	-	
	Dimension and visual inspection report as per drawing / Data Sheet	Yes	Yes	-	-	
	Radiography of heat exchangers as	Yes	Yes	-	-	

	applicable					
	Hydro test of heat exchangers : Note 3	Yes	Yes	Yes	-	
	Final painting and cleaning	Yes	Yes	-	-	
5.	**Discharge gas filter**					
	Manufacturer's test certificate	Yes	Yes			
	Final dimensions/Pneumatic test	Yes	Yes	Yes		
6.	**Control Panel & Soft starter**					
	Dimensions / visual as per drawing	Yes	Yes	-	Yes	
	Functional test	Yes	Yes	-	Yes	
7.	**Instrumentation & Control**					
	Manufacturers test certificates/ calibration certificates of meas. Instruments for transmitters, gauges, switches & safety valve, filter, SS tubes, acoustic material, CS pipe, fittings, flanges, fasteners, valves, CO_2 flooding system, PRV+SSV, air compressor, air dryer etc.	Yes	Yes	-	-	
	Manufacturer test certificates, testing & functioning of (PLC / HMI), MFM, Interlocking, Local Gauge Panel, CO2 flooding system, GD & LEL functioning	Yes	Yes	-	Yes	
8.	**Compressor package**			-	-	
	Surface preparation after cleaning & prior to primer painting, dimensions / visual as per drawing package	Yes	Yes	-	Yes	
	Assembly check as per P&ID	Yes	Yes	-	Yes	
	100% radiography of high pr. & low pr. gas piping	Yes	Yes			
	Mechanical string test	Yes	Yes	-	Yes	
	Field trail run	Yes	Yes	-	Yes	
	Package performance test at site at guaranteed parameters	Yes	Yes	-	Yes	

LEGENDS : D = Documents to be submitted by vendor / sub-vendor **; R =** Review of documents by Client/consultant**; TW =** witness by third party; **W =** Witness by client or consultant.	
NOTES:	
1	Crank Shaft, Connecting Rod: UT / MPT shall be conducted either in forged or in finished condition.
2	Strip test is limited to open Crank Case cover, X-Hd guide & Dist. Pc. Cover and opening of bore & other parts, Piston, one valve per cylinder.
3	Review of manufacturer's test reports/certificates of all parts
4	If bidder is only packager and not manufacturer of main CNG compressor the standard QAP of compressor OEM with test report of compressor and motor from manufacturer or as witnessed by TPE appointed by manufacturer shall be accepted

26.0 PREFERRED MAKES:

Sl. No.	Item description	Preferred Makes
1.	Soft Starter	Siemens/ABB/Rockwell/Schneider
2.	FLP motors	ABB / Compton Greaves / Kirloskar / Siemens / Bharat Bijlee/Weg/Marelli/LHP
3.	FLP Switchgear, FLP boxes, Cubicles	Baliga/ FCG/ FPE / Flexpro/M/s Sudhir
4.	Switches/fuses/contactors	L & T/ GEC/ Siemens/ Schneider
5.	Push Button	L & T/ Vaisno/ Technik
6.	MCCB	Siemens/ Legrand /Schneider
7.	Vibration switch	Robertshaw Control/ Murphy
8.	PLC	Rockwell Automation/ GE Fanuc/ Siemens/ Allen Bradley / L&T/Telemechnique/ Schneider
9.	IR Gas detectors	General Monitors / Crowcon / Honeywell / Sieger / Detronics/ Khrome Schroder / Net safety (Emerson) / ESP safety Pvt. Ltd / M/s Oldham
10.	UV Flame detectors	General Monitors / Crowcon / Honeywell / Sieger/ Detronics / Khrome Schroder/ Net safety/ ESP safety Pvt. Ltd / M/s Oldham
11.	Mass Flow meter	Micromotion CNG 50 / E&H CNGmass DCI
12.	Pressure Transmitter	Druck/ Wika/ Honeywell/ ABB/Fisher/ Rosmount/ Yokogowa
13.	Pressure Regulator & Slam Shut Valve	M/s Pietro Fiorentini S.p.A. (Italy)/ M/s Emerson Process Management/ M/s RMG-Regel Messtechnik (Germany) / M/s Mokveld Valves BV (Netherlands)/ Tartarini / Fisher /M/s Gorter Controls (Netherlands)/M/s Dresser/ Nirmal /M/s Vanaz
14.	Pressure Safety Valve	M/s BHEL, OFE & OE Group (New Delhi)/ M/s Keystone Valves (India) Pvt. Ltd. Baroda/ M/s Sebim Sarasin Valves India (P) Ltd. (New Delhi/ Halol-Gujarat)/ M/s Tyco Sanmar Ltd. (New Delhi/ M/s Parcol SPA, Italy/ M/s Nuopignone, Italy/ M/s Sarasin, France/ M/s Tai Milano SPA, Italy/ M/s Fisher Rosemount (Now M/s Emerson Process) Singapore/ Mercer USA/ Fainger-Leser/ M/s Technical
15.	Pressure Gauges & Temperatures Gauges.	M/s AN Instruments Pvt. Ltd., New Delhi/M/s Altop/ M/s General Instruments Ltd., Mumbai (M/s GIC) / M/s WIKA

16.	RTDs :	M/s General Instruments Ltd. Mumbai/ M/s Nagman Sensors (Pvt.) Ltd./ M/s Pyro Electric, Goa/ M/s Altop/M/s Wika
17.	SS Tubes for CNG application	M/s Sandvik, Sweden/ M/s Tubacex/M/s Ratnamani
18.	SS tube Fittings for CNG application	M/s Swagelok (USA)/ M/s Parker (USA) /M/s SSP, USA/M/s Hylok/M/s Dk-Lok
19.	Plug/ball Valve for air/ water/low pressure gas	M/s Nordstrom Valves Inc. USA/ M/s Serck Audco Valves, UK/ M/s Breda Energia Sesto Industria Spa, Italy/ M/s Sumitomo Corporation, New Delhi/ M/s Fisher Xomox Sanmar India Ltd., New Delhi/ M/s Larsen & Toubro Ltd. (Audco India Limited), Chennai/M/s Microfinish/M/s Virgo/M/s BDK/M/s Petro valves
20.	Solenoid Valve	M/s ASCO / M/s Rotex / M/s Parker Hanifen/M/s Swagelok
21.	On Off SS ball/ needle/ non-return valve for CNG application	M/s Parker / M/s Swagelok/M/s SSP / M/s Dk-Lok for CNG application
22.	Cables and wires	INCAB/ Universal/ ASEAN/CCI/ FORT Gloster/ Finolex/ KEI/ Hylite/Polycable/Associated cables
23.	Barrier/ Isolators/Surge protector	MTL / Phoenix / P&F
24.	Air exchanger	GEI Hamon Ind Ltd/ GEA India / Patel Air temp/CP
25.	SMPS	Telemecanique(Schnieider)/ Siemens/Phoenix
26.	Pressure switch	Orion/Switzer/Danfoss/Wika/IFM

Notes:

a. For procuring bought out items other than those listed above, the same may be acceptable subject to prior approval of Consultant/owner to the following: -

i. The vendor/ supplier of bought out item(s) is a regular and reputed manufacturer/ supplier of said item(s) for intended services and the sizes being offered is in their regular manufacturing/ supply range. Further, the bidder has to certify that the item(s) has/have been regularly used by them in all the packages for the last two years and they are working satisfactorily.

ii. The vendor/ supplier should not be in the Holiday list of BGL / Any other PSU.
The bidder should enclose documentary evidences i.e. PO copies, Inspection Certificate etc. for the above, along with their bids.

b. Some Items indicate only Indian Makes. Successful Foreign bidders may take prior approval of any other make also for which complete technical credentials (PO copies, Inspection Certificate etc.) of the proposed vendors shall have to be submitted for evaluation by Purchaser/Consultant.

27.0 CHECK LIST FOR SCOPE OF SUPPLY FOR RECIPROCATING GAS COMPRESSOR PACKAGE: NOTES :

a. Bidder shall furnish all equipment, drivers, auxiliary systems, instruments and controls and safety devices as per the enquiry document. Anything required over and above what is specified, for safe and satisfactory operation of the equipment package shall be included by the Bidder in his scope.

b. Bidder to write YES/NO against each item. Bidder is required to include complete scope, as such 'NO' is not warranted. However, in case for any of the items if vendor's reply is 'NO', vendor should give reasons for the same.

c. Bidders' scope of supply shall include but not be limited to the following:

Sr.No.	Description	Specified by purchaser (Yes/No)	Included by Bidder (Yes/No)	Remarks
1	**Each Reciprocating Compressor package complete with :**			
1.1	void			
1.2	Suction / discharge pulsation dampers /Volume bottles	**Yes**		
1.3	Process equipment such as separator complete with supports, drain system for separators	**Yes**		
1.4	Air cooled, lube oil, cooling water, inter-stage and discharge gas coolers with necessary air cooling arrangement	**Yes**		
1.5	Combined or separate closed circuit cooling water system for compressor (As required)	**Yes**		
1.6	Lubricating oil system for compressor	**Yes**		
1.7	Safety relief valves on each discharge stage of the compressor.	**Yes**		
1.8	All interconnecting oil, gas, water, air piping within the compressor package	**Yes**		

1.9	All valves, tubing, fittings as specified and required within the compressor package	**Yes**		
1.10	Fuel supply hardware complete with SS piping, control valves, Regulators, Flow-meter, filter, vent/drain within the package suitable for the specified fuel gas	**Yes**		
1.13	Common skid for compressor and other auxiliary systems	**Yes**		
1.14	Acoustic enclosures for compressor for noise attenuation up to 70 dBA @ 1 m distance fitted with fire detection and extinguishing system as specified	**Yes**		
1.15	Instrumentation and control system complete with PLC based control panel, configuration for supervisory	**Yes**		
	computer and data acquisition, instrumentation as specified.			
1.16	Cabling with cable trays for all the electrical devices within the package.	**Yes**		
1.17	Mass flow meter with integral display	**Yes**		
1.18	Inlet Pressure Regulators (Compressor Suction)	**Yes**		
1.19	Priority Panel (as specified) at Package Discharge	**Yes**		
1.20	Compressor gas inlet basket strainer, permanent inlet filter.	**Yes**		
1.21	Y-type strainers/paper filter, valves, sight flow indicators, check valves, auto drain traps as required for various compressor auxiliary systems, i.e. frame lubrication system, cylinder lubrication, cooling water systems etc.	**Yes**		
1.22	Manual package isolating valves and auto inlet isolation valve	**Yes**		
1.23	All couplings and guards	**Yes**		
1.24	Flywheels, barring device	**Yes**		
2	**Spares and Tools / Tackles**			
2.1	Mandatory Spares if specified in the TS ” (Indicate separate price for each item)	**Yes**		

2.2	Erection and commissioning spares as recommended by Bidder including lube oil consumables etc. as required for erection & commissioning of each compressor package.	**Yes**		
2.3	Operation and maintenance of each package by the Bidder for five years	**Yes**		
2.4	Four years normal operation and maintenance spares over and above the spares as required during one year warranty period of each package by the Bidder	**Yes**		
2.5	Quote for five years Normal operation & maintenance spares (excluding lube oil etc.)	**No**		
2.6	Special tools and tackles required for normal operation & maintenance of each equipment of compressor package as required and recommended by the Bidder	**Yes**		
3	**Inspection and Testing**			
	As specified on the datasheets and tech. Spec.	**Yes**		
4	**Vendor data and drawings**			
	All data & drawings as required per VDR format	**Yes**		
5	Erection, commissioning at site of the complete package	**Yes**		
6	Miscellaneous			
6.1	Foundation and anchor bolts	**Yes**		
6.3	Acoustical and mechanical analysis report & pulsation study (apporoach-3)	**No**		
6.4	Additional items not specified by Purchaser but recommended by Bidder for safe smooth and normal operation. (Bidder shall indicate separate list of such items in his proposal)	**Yes**		

6.5	Optional price quoted for complete compressor package with Non- flame proof electric panel in lieu of	**No**		
	flame proof electric panel.			
6.6	Motor data sheet and data sheet for Gas detection system and UV Detection system duly filled.	**Yes**		
6.7	Combined Speed-Torque Characteristic curve of Motor and Compressor under Star-Delta starting at rated inlet pressure.	**Yes**		
6.8	Electrical Load summary	**Yes**		
6.9	Catalogues of electric motor, flame proof equipments and Instrumentation	**Yes**		
6.10	Power required from UPS Supply (230 V AC Single Phase	**Yes**		
6.11	Power required from Non UPS Supply (415V TPN)	**Yes**		
7	Operation maintenance contract including all operating spares, consumables, manpower etc.	**Yes**		
7.1	It is recommended to use HP make lubricants for operation of compressor packages	**Yes**		

28.0 FORMAT OF DEVIATION TO THE TECHNICAL SPECIFICATION:

All deviations sought by the vendor shall be furnished in this format. If some deviations / observations / comments are furnished by the vendor at some other places of the offer, the same shall not be considered as deviation. Purchaser may accept some deviation in the interest of project. However, 1.5 times the cost of deviation shall be loaded in the offered cost for evaluation purpose.

SL. No.	Clause no.	Tender Specification	Deviation taken	Reasons for deviations / remarks

Certified that, only the above-mentioned deviations have been taken against this tender.

Name of the Bidder

Signature
Seal of the Company

LIST OF RECOMMENDED THIRD PARTY INSPECTION AGENCY (TPIA)

SL. NO	NAME OF TPI	ADDRESS	PHONE NO	FAX NO
1	Tata Projects Ltd.	22,Sarvodaya Society,Nizampura,Baroda-390002	0265-2392863	0265-2785952
2	Bax counsel Insepection Bureau Pvt. Ltd.	303, Madhava,Bandra Kurla Complex, Bandra(E),Mumbai-400051	022-26591526,022-26590236	022-26591526
3	Germanischer Lloyd	4th Floor, Dakshna Building, Sec-11, Plot NO.2, CBD Belapur, Navi Mumbai 400 614	022-4078 1000	022-4024 2935
4	ABS Industrial Verification Ltd., Mumbai	404,Mayuresh Chambers,Sector-11,CBD Belapur(E),Navi Mumbai-400614	022-27578780 /1 /2	022-27578784 / 5
5	Certification Engineers International Ltd.	EIL Bhavan,5th floor,1,Bhikaji Camma Place,New Delhi-110066	011-26167539,26102121	011-26101419
6	Dalal Mott MacDonald	501, Sakar -II, Ellisbridge,Ahemedabad-380006	079-26575550	079-6575558
7	International Certification Systems	E-7,Chand Society, Juhu Road, Juhu, Mumbai-4000049	022-26245747	022-226248167
8	SGS	SGS India Pvt. Ltd.,SGS House,4B,A.S.Marg,Vikhroli(W),Mumbai-400083	022-25798421 to 28	022-25798431 to 33
9	Intertek Moody	9th Floor, Kanchenjunga Building, 18-Barakhamba Road, New Delhi-110001	011-4713 3900	011-4713 3999
10	TUV SUD South Asia	C-153/1, Okhla Industrial Ara, Phase-1, New Delhi-110020	011-3088 9611/9797	011-3088 9598

11	TUV Rheinland (India) Pvt. Ltd.	F-51, Kailash Complex GF, Veer Savarkar Marg, Vikhroli Park Site, Vikhroli(W), Mumbai-400079	022-4215 5435	022-4215 5434
12	Vincott International India Assessment Service Pvt. Ltd.	C-301, Mangalya Premises Cooperative Soc. Ltd, Off. Marol Maroshi Road, Andheri(E), Mumbai-400959	022-4247 4100	022-4247 4101
13	Meenar Global Consultants	Mr. Nitin Taneja (Project Manager)	M: +91-9711212783 T: +91-129-4072836	Web : www.meenaar.in Email : nitin.taneja@meenaar.in
14	VCS Quality Services Pvt. Ltd.	505, 5th floor, 360 Degree Business Park, Next to R-Mall, L.B.S. Marg, Mulund West, Mumbai 400080	Tel: 91 22 21649720	091 22 21646392

	CONTRATOR		**QUALITY ASSURANCE PLAN FOR COMPRESSOR**	CLIENT:	**BGL**
				PROJECT:	**CNG & CITY GAS DISTRIBUTION**
	ORDER NO. & DATE			PACKAGE NO.	
	SUB-CONTRACTOR			PACKAGE NAME	**CNG DISPENSERS**
	ORDER NO. & DATE				

S.NO.	OPERATION / RAMETER	CHARACTERISICS / PARAMETERS	ACCEPTANCE CRITERIA & CERTIFICATION	VENDOR	TPIA	CLIENT/ PMC	REMARKS
Bought Out items & Equipment details							
1.	Canopy & Frame Dimensional Report	Dimension Reports	As per Technical specification & GAD	p	W/R	R	
2.	Gas Intercooler	Dimensional, Chemical, Mechanical, Hydro test, Physical, Heat Chart, Cooling & heating load calculation	As per Technical specification I Data sheet I Calculation Reports	p	W/R	R	
3.	Water radiator	Dimensional, Chemical, Mechanical, Hydro test, Physical, Heat Chart	As per Technical specification/Data sheet / Calculation Reports	p	W/R	R	
4.	Oil Heat Exchanger	Dimensional, Chemical, Mechanical, Hydro test, Physical, Heat Chart WPS/PQR	As per Technical specification/Data sheet / Calculation Reports	p	W/R	R	
5.	Compressor block	Dimensional, Chemical, Mechanical, Hydro test, Physical, Heat Chart, Ultrasonic & Radiography report for Crank shaft, Connecting rod. Cylinder Piston	As per Technical specification/Data sheet/Calculation Reports /	p	W/R	R	
6.	Gas Engine	Test/compliance/performance / warranty certificates	As per Technical specification/ Data sheet/ wake frequency Calculation Reports	p	W/R	R	
7.	Hydraulic Pump	Test/compliance/performance/ warranty certificates	As per OEM specifications / Data sheet	p	W/R	R	
8.	Pressure Regulating Valve /Direction & flow control valve	Test/compliance/performance/ warranty certificates	As per OEM specifications / Data sheet	p	W/R	R	
9.	Safety Relief Valve	Test/compliance/performance/ warranty certificates	As per OEM specifications/Data sheet/Sizing calculation report	p	W/R	R	

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10.	Temperature Gauge & Thermo well	rest/compliance/performance/warranty certificates / calibration report	As per Technical specification/Data sheet/ wake frequency Calculation Reports	p	W/R	R	
11.	Pressure gauge	visual, Size verification, Fitment & alignment, Functional & operational, Calibration report, Test certificates for bought out items, Hydro test pressure test	Technical specification & Approved data sheets	p	W/R	R	
		Visual, Size verification, Fitment &					
12.	Differential pressure gauge	alignment, Functional & operational, Calibration report Test certificates for bought out items, Hydro test pressure test	specification & Approved data sheets	p	W/R	R	
13.	Pressure Transducer & Transmitter	Location as per P& ID, Fitment & alignment, calibration report, Test certificates of bought out items, pressure test, Operational & functional, current consumption w.r.t pressure, IP ratings, supply voltage, Output signal voltage	Technical specification & Approved data sheets	p	W/R	R	
14.	Temperature Transducer & Transmitter	Location as per P&ID, Fitment & alignment, Calibration report, Test certificates of bought out items, pressure test, Operational & functional, current consumption w.r.t pressure, IP ratings, supply voltage Output signal voltage		p	W/R	R	
15.	Water pump	Performance report, Fitment & alignment, Test certificates, Compliance report, chemical & physical reports	Technical specification & Approved data sheets	p	W/R	R	
16.	55 Needle I Block & Bleed valve	Chemical, Mechanical, Hydro test, Physical Heat Chart	As per Technical specification/ Data sheet	p	W/R	R	
17.	Check Valve	Chemical, Mechanical, Hydro test, Physical, Heat chart	As per Technical specification/ Data sheet / calculation report	p	W/R	R	
18.	55 Tube	Chemical, Mechanical, Hydro test, Physical Heat Chart	As per technical specifications/ Data sheet	p	W/R	R	
19.	C5 tube	Chemical, Mechanical, Hydro test, Physical, Heat Chart	As per OEM specifications/ Data sheet	p	W/R	R	

20.	Isolation Ball valve	Visual, Dimensional, Fitment & Alignment, Physical test, Chemical Test, Operational & functional, Leak test, Test certificates of bought out items, Cv verification w.r.t data sheet	Technical specification & Approved data sheets	p	W/R	R	
21.	55 Tubing & Fittings	Visual, Dimensional, Fitment & Alignment as per P&ID shown, Physical Test, Chemical Test, Operational & functional, Leak test, Test certificates of bought out items	Technical specification & Approved data sheets	p	W/R	R	
22.	55 Manifold	Visual, sizing verifications, Fitment & Alignment, Operational & functional Leak test	As per OEM specification & design	p	W/R	R	
		Certificate of bought out items, Flow direction as per P&ID					
23.	Inlet & Outlet filter	Visual, Dimensional, Fitment & Alignment, Physical Test, Chemical Test report, Operational & functional, Leak test, Hydro test filling sizing calculation	Technical specification I Approved data sheets / Filter Sizing calculation sheet	p	W/R	R	
24.	Filter Elements	Visual, Dimensional, Fitment & Alignment, Test, Certificates of bought out item operational & functional, leak Test, hydro test, filter sizing & pressure drop calculation with elements report, Operational & functional, Leak test, Hydro test filling sizing calculation	Technical specification I Approved data Sheets / Filter Sizing calculation sheet	p	W/R	R	
25.	Pneumatic Actuators	Performance report, Fitment & alignment test certificates Compliance report, chemical & physical reports	As per OEM specifications/Data sheet	p	W/R	R	
26.	Air compressor Block & vessels	Performance report, Fitment & alignment, Test certificates Compliance report, chemical & physical reports	As per OEM specifications /ASME code It approved Data sheet	p	W/R	R	
27.	Pressure switch	Performance report, Fitment & alignment, Test certificates, calibration, Compliance report, chemical & physical reports	As per OEM specifications/ Data sheet	p	W/R	R	

28.	ESD & Hooter	Fitment & alignment, Test certificates, Compliance report, chemical & physical reports	As per OEM specifications/ Data sheet	p	W/R	R	
29.	Solenoid Valve & manifold	Performance report, Fitment & alignment, Test certificates Compliance report, chemical & physical reports	As per OEM specifications/ Data sheet	p	W/R	R	
30.	Main Motor & Auxiliaries Motor	Routine Test, Functional Test, Compliance report, Alignments test.	Technical specification I Approved data sheets	p	W/R	R	
31.	Flameproof Junction Box	Test report, compliance report, Physical & chemical report	As per OEM specifications /Data sheet	p	W/R	R	
32.	Mass Flow meter	Performance report, Fitment & alignment, Test certificates, Compliance report, calibration report, chemical & physical report.	Technical specification I Approved data sheets	p	W/R	R	
33.	Gas Detector	Performance report, Fitment & alignment, test certificates, Compliance report, calibration report,	Technical specification / Approved data sheets	p	W/R	R	
34.	Flame Detector	Performance report, Fitment & alignment, Test certificates, Compliance report, calibration report, chemical & physical reports	Technical specification / Approved data sheets	p	W/R	R	
35.	Control panel	Test report, compliance report, Routine test, Physical & chemical report	As per OEM specifications/ Data sheet	p	W/R	R	
36.	Tube light & Aviation lamp	Test report, compliance report, Routine test, Physical & chemical report	As per OEM specifications/ Data sheet	p	W/R	R	
37.	PLC/HMI	Test report, compliance report, Routine test	As per OEM specifications/ Data sheet	p	W/R	R	
38.	FRLS cable	Test report, compliance report, Routine test, HV-IR test, Physical & chemical report	As per OEM specifications/ Data sheet	p	W/R	R	
39.	C02 cylinder	Hydro stretch test, leak test, Physical & chemical report, Filling permission (PESO) report	Technical specification I Approved data sheets	p	W/R	R	
40.	Air Dryer	Test report, compliance report, Routine test, Physical & chemical report	As per OEM specifications/ Data sheet	p	W/R	R	
41.	Flame arrester	Test report, compliance report, Routine test, Physical & chemical report	As per OEM specifications/ Data sheet	p	W/R	R	

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42.	Structural stability/FEA reports	Approved Load calculation report, stability, Static load analysis reports	As per Technical specification	p	W/R	R	
43.	Package CCOE approval certificates	Valid PESO package approval certificates, Number plate embossing with PESO no. & other details.	As per Technical specification & approved Name plate	p	W/R	R	
44.	All electrical PESO certificates	Valid PESO certificates of all electrical & hazardous components	As per PESO certificates	p	W/R	R	
45.	Fire & flame retardant PU foam	Test certificates	As per PESO & PNGRB guidelines	p	W/R	R	
46.	Pressure Vessels	Dimensional, Chemical, Mechanical, Hydro test, Physical, Ultrasonic test, DPT test & 100 % Radiography test	As per ASME sec. VIII div. 1Code & standards, Wall thickness calculation	p	W/R	R	
47.	Vibration switch	Performance report, Fitment & alignment, Test certificates, Compliance report, calibration report chemical & physical reports	Technical specification I Approved data sheets	p	W/R	R	
48.	Hydraulic & pneumatic hoses	Visual, Dimensional, Fitment & Alignment, Physical Test, Chemical Test report, Operational & functional, Leak test, Hydro test, Hose conductivity	Technical specification I Approved data sheets/ Manufacturer standards	p	W/R	R	
49.	Recovery bottle	Dimensional, Chemical, Mechanical, Hydro test, Physical, Ultrasonic test, DPT test & 100 % Radiography test	As per ASME sec. VIII div. 1Code & standards, Wall thickness calculation	p	W/R	R	
50.	PRV & Slam shut off valve	Visual, Dimensional, Fitment & Alignment, Physical Test, Chemical Test report, Operational &functional, Leak test, compliance report	Technical specification I Approved data sheets/ Manufacturer standards	p	W/R	R	
51.	Moisture separator	Dimensional, Chemical, Mechanical, Hydro test, Physical, Ultrasonic test, DPT test & 100 % Radiography test, functional test	As per ASME sec. VIII div. 1Code & standards, Wall thickness calculation	p	W/R	R	
52.	Pulse vessels	Dimensional, Chemical, Mechanical, Hydro test, Physical, Ultrasonic test, DPT test & 100 % Radiography test functional test	As per ASME sec. VIII div. 1Code & standards, Wall thickness calculation	p	W/R	R	
53.	No flow switch	Visual, Fitment & orientation, Operational & functional, Manufacturer test report, calibration report	Technical specification I Approved data sheets/ Manufacturer standards	p	W/R	R	
54	Conical & Y-strainer	Chemical, Mechanical, Hydro test, Physical, Heat chart, Operational & functional	Technical specification I Approved data sheets/ Manufacturer standards	p	W/R	R	

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Complete Assembly Simulation a. Testing Details

55.	Complete Assembly @ pulsating pressure Leak Test	Leak Test Throughout on all Joints By using Soap solution and Holding time up to 4hrs @ Pressure 200 255 Bar(g) Media-Nitrogen	Technical specifications & OEM test procedure.	p	W/R	R	
56.	Complete Assembly @ Leak Test	Leak test Throughout on all Joints By using Soap solution and Holding time up to 4hrs @ Pressure 200 255 Bar(g) Media-Nitrogen	Technical specifications & OEM test procedure.	p	W/R	R	
57.	Main Motor overload relay simulation	Tripping test during routine test	As per Approved control philosophy	p	W/R	R	
58.	Gas Engine overload test	Simulation as per OEM procedure	As per Approved control philosophy	p	W/R	R	
59.	Water jacket temperature check	Simulation as per OEM procedure	As per Approved control philosophy	p	W/R	R	
60.	Gas engine Governor functional test	Simulation as per OEM procedure	As per Approved control philosophy	p	W/R	R	
61.	Vibration damper functional test	Simulation as per OEM procedure	As per Approved control philosophy	p	W/R	R	
62.	All radiator fan & water pump Overload relay simulation	Tripping test during routine test	As per Approved control philosophy	p	W/R	R	
63.	Air compressor over load relay simulation	Tripping test during routine test	As per Approved control philosophy	p	W/R	R	
64.	Air compressor pressure failure test	Tripping test during routine test	As per Approved control philosophy	p	W/R	R	
65.	over & under voltage simulation test	Simulation check	As per Approved control philosophy	p	W/R	R	
66.	Earth leakage failure	Simulation check	As per Approved control philosophy	p	W/R	R	
67.	Failure of any wire breck	Crimping connection check	As per Approved control philosophy	p	W/R	R	
68.	Failure Barriers	Simulation check	As per Approved control philosophy	p	W/R	R	

69.	Low & High oil level alarms check	Simulation check	As per Approved control philosophy	p	W/R	R	
70.	Low & High oil temperature Alarm check	Simulation check	As per Approved control philosophy	p	W/R	R	
71.	Low & High Water temperature alarm check	Simulation check	As per Approved control philosophy	p	W/R	R	
72.	Low & High suction gas Temperature Alarm check	Simulation check	As per Approved control philosophy	p	W/R	R	
73.	Low & High 1"stage Discharge Gas	Simulation check	As per Approved control philosophy	p	W/R	R	
74.	Low & High 2" stage Discharge Gas temperature alarm check	Simulation check	As per Approved control philosophy	p	W/R	R	
75.	Low & High 3"' stage Discharge Gas temperature alarm check	Simulation check	As per Approved control philosophy	p	W/R	R	
76.	Low & High Final discharge gas temperature	Simulation check	As per Approved control philosophy	p	W/R	R	
77.	Low & High suction pressure simulation test	Simulation check	As per Approved control philosophy	p	W/R	R	
78.	1" stage Low & high pressure fault	Simulation check	As per Approved control philosophy	p	W/R	R	
79.	2"• stage Low & high pressure fault	Simulation check	As per Approved control philosophy	p	W/R	R	
80.	3"' stage Low & high pressure fault	Simulation check	As per Approved control philosophy	p	W/R	R	
81.	Low bank cascade Low high pressure fault	Simulation check	As per Approved control philosophy	p	W/R	R	
82.	Low & High final discharge pressure fault	Simulation check	As per Approved control philosophy	p	W/R	R	
83.	Med bank cascade Low a high pressure fault	Simulation check	As per Approved control philosophy	p	W/R	R	

84.	High bank cascade Low & high pressure Fault	Simulation check	As per Approved control philosophy	p	W/R	R	
85.	Low & High Emergency pressure fault	Simulation check	As per Approved control philosophy	p	W/R	R	
86.	Low & High water pressure fault	Simulation check	As per Approved control philosophy	p	W/R	R	
87.	3 phase Relay failure	Simulation check	As per Approved control philosophy	p	W/R	R	
88.	Compressor auto start Simulation test	Simulation check	As per Approved control philosophy	p	W/R	R	
89.	Compressor auto stop Simulation test	Simulation check	As per Approved control philosophy	p	W/R	R	
90.	Compressor auto start/stop bank Simulation	Simulation check	As per Approved control philosophy	p	W/R	R	
91.	Gas Detector-1 & 2 Simulation test	Simulation check	As per Approved control philosophy	p	W/R	R	
92.	Flame Detector-1& 2 simulation test	Simulation check	As per Approved control philosophy	p	W/R	R	
93.	Co2 flooding system alarm simulation	Simulation check	As per Approved control philosophy	p	W/R	R	
94.	C'o2 weight loss Monitoring test	Simulation check	As per Approved control philosophy	p	W/R	R	
95.	Tube light functional test	Functional test	As per Approved control philosophy	p	W/R	R	
96.	Aviation light functional test	Functional test	As per Approved control philosophy	p	W/R	R	
97.	Door limit & selector switch functional test	Functional test	As per Approved control philosophy	p	W/R	R	
98.	All ESD functional test	Functional test	As per Approved control philosophy	p	W/R	R	
99.	Failure of Mass flow meter meeting	Functional test	As per Approved control philosophy	p	W/R	R	

100.	Failure of Mass flow meter communication loss	Functional test	As per Approved control philosophy	p	W/R	R	
101.	Auto change over primary CPU to secondary By failure due to any reason	Redundant CPU auto changeover test by manual failure	As per Approved control philosophy	p	W/R	R	
102.	Canopy structure painting inspection at Works surface preparation to be inspected after cleaning and before application of first coat primer	Functional test	As OEM procedure	p	W/R	R	
103.	No load Mechanical run test (NLMRT) of he compressor with rated speed and shop driver (4 hours minimum)	Functional test	As OEM procedure	p	W/R	R	
104.	High Bearing temperature simulation	Functional test	As OEM procedure	p	W/R	R	
105.	Delivery test (200 240 kgcm2) procedure Media Nitrogen I NG@uction-16 19 kg/cm2	Performance test	As technical specification & OEM	p	W/R	R	
106.	Noise test	Performance test	As technical specification & OEM factory procedure	p	W/R	R	
107	vibration test as per standard at site	Performance test	As technical specification & OEM factory procedure	p	W/R	R	
108	Overall power consumption (KWH)	Performance test	As technical specification	p	W/R	R	
109	Input power @ full rated load	Performance test	As technical specification & OEM procedure	p	W/R	R	
110	Three phase power in (KW)	Performance test	As technical specification & OEM procedure	p	W/R	R	

111	compressor Load %	Performance test	As technical specification & OEM procedure	p	W/R	R	
112.	actual efficiency of compressor	Performance test	As technical specification & OEM procedure	p	W/R	R	
113.	Specific power consumption of gas In KWH/KG	Performance test	As technical specification & OEM procedure	p	W/R	R	
114.	Vibration switch functional test	Performance test	As technical specification & OEM procedure	p	W/R	R	

PERATIONAL PHILOSOPHY TEST										
115. PRIORITY PHILOSOPHY DETAILS	**Actuator/SOY Position (NO/ NC)**									
Vendor specify control philosophy	**Suction**	**Oil**	**Low bank cascade**	**Med bank cascade**	**High Bank cascade**	**Emergency / Dispenser line**	**Mobile cascade Bank**	**C02 cylinder 1**	**C02 Cylinder 2**	**Bus Dispenser Bank**
When compressor normally stop										
When compressor normally start by pressing Push button										
When compressor normally stop by pressing Push button										
When compressor normally stop by pressing ESD										
When Gas detector Activates above LEL level.										
When compressor Auto start condition										

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When compressor Auto stop condition										
When Flame detector Activate										
When Co2 flooding system Activate										
When Low suction & High suction										
When stage 1 High & low pressure										
When Stage 2 High & low pressure										
When stage 3 High & low pressure										
When MCV pressure @255 kg/cm2										
When all stationary cascade bank pressure reached at @255 kc: /cm2										
When Main motor or Gas engine trip/overload										
When auxiliary motor trip										
When over & under voltage										
When Low & High water pressure										
When Stg.1 Air Intercooler fail										
When Stg.2 Air Intercooler fail										
When Stg.3 Air Intercooler fail										
When oil Intercooler fail										
When low & High air pressure failure										

When Final Stage 2 gas discharge temperature (After intercool) high										
When Final Stage 3 gas discharge temperature (After intercool) high										
When High vibration observed										
When vent flare Mass flow meter meeting failed										
When High bearing temperature observed										
When no flow switch Failed										
When lubrication sump pressure High										
When lubrication sump pressure low										

Notes :-

1. The above testing and acceptance criteria are minimum requirements; however, manufacturer shall ensure that the product shall also comply to the additional requirements as per particular Technical Specification (PTS) and Data Sheet.
2. The supplier shall submit their own detailed QAP prepared on the basis of above **/** Technical specification for approval of Owner / Owner's representative.
3. Supplier shall submit calibration certificates of all instruments/Equipment to be used for inspection and Testing to TPIA with relevant procedures and updated standards for TPIA review/ Approval. All reference codes **/** documents shall be arranged by vendor for reference of TPIA at the time of inspection.
4. Owner **/** Owner's representative include TPIA will have the right to inspect activity of manufacturing at any time.
5. TPIA along with Owner **/** Owner's representative shall review/approval all the documents related to QAP/Quality manuals/Drawings etc., submitted by supplier.
6. Contractor shall in coordination with supplier/sub vendor shall issue detailed production and inspection schedule indicating the dates and the location of facilities Owner/Owner's representative and TPIA to organize inspection.
7. Special manufacturing procedure have to be specially approved or only previously approved procedures have to be used, in case of conflict between specification more stringent condition shall be applicable.
8. The supplier shall submit separate control logic sheet along with actuator/SOV operation philosophy.
9. The supplier shall read the Quality plan if any part is not witnessed then it shall be confirm before Third party inspection.

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