

PROJECT		INSTALLATION OF GTC AT GANDHAR		CLIENT		GAIL	
UNIT		New Compressor Area at Gandhar		JOB NO.		B240	
				UNIT NO.		910	
ITEM NO	910-K-901	CASE	CASE 1				
SERVICE		NATURAL GAS COMPRESSOR					
TYPE		CENTRIFUGAL					
LOCATION		GANDHAR (UNDER ROOF)					
NO OF COMPRESSOR REQUIRED							
	IN REGULAR USE	ONE					
	AS SPARE	NONE					
LUBRICATING OR NON LUBRICATING TYPE							
TYPE OF DRIVER							
	REGULAR COMPRESSOR	GAS TURBINE					
	SPARE COMPRESSOR	NONE					
VARIABLE SPEED MOTOR REQUIRED		NO					
COMPRESSOR CONNECTED TO EMERGENCY POWER/STEAM		NO					
NUMBER OF STAGES		ONE (NOTE-22)					
OPERATION		CONTINUOUS					
PROPERTIES OF GAS(COMPOSITION AT SUCTION)							
COMPOSITION (MOLE %)		CASE-1A(NOTE-13,25,27)	CASE-1B(NOTE-13,25,28)				
WATER VAPOUR		NIL	NIL				
HYDROGEN		-	-				
NITROGEN		0.23	0.23				
OXYGEN							
CARBON MONOXIDE		-	-				
CARBON DIOXIDE		2.36	2.36				
HYDROGEN SULPHIDE		0.00141	0.00141				
METHANE		90.35	90.35				
ETHYLENE							
ETHANE		5.93	5.93				
PROPYLENE							
PROPANE		1.06	1.06				
I-BUTANE							
N-BUTANE		0.05	0.05				
I-PENTANE							
N-PENTANE		-	-				
HEXANE PLUS(AVERAGE M.WT.)		-	-				
AMMONIA							
HYDROGEN CHLORIDE							
CHLORINE							
INERTS(AVERAGE M.WT.)							
AIR(DRY BASIS)							
FLOW RATE FOR ONE COMPRESSOR		NM3/HR					
		KG/HR	110121 (NOTE-1,25)	110121 (NOTE-1,25)			
AVERAGE M.WT.		DRY BASIS	17.88	17.88			
DENSITY		DRY BASIS	25.42-28.75	23.69-24.65			
COMPRESSIBILITY FACTOR			0.9231-0.936	0.9299-0.9374			
RATIO OF SPECIFIC HEATS (CP/CV)			1.3731-1.3994 (NOTE-21)	1.3717-1.3875(NOTE-21)			
CORROSIVE/EROSIVE ELEMENTS			NIL	NIL			
PARTICLE SIZE OF EROSIVES (IF ANY)							
IS DESIGN FOR NACE CODE IS REQUIRED			NO	NO	--		
LINE RATING							
SUCTION			600# (NOTE-19,20)	600# (NOTE-19,20)			
DISCHARGE			900# (NOTE-19)	900# (NOTE-19)			
OPERATING CONDITION							

0	12-MAR-2019	Re-Issued For Comments/Engineering	GS	JKS	SS
B	31-JAN-2019	omments incorporated & Re-Issued For C	GS	JKS	SS
A	16-JAN-2019	Issued For Comments	GS	JKS	SS
Rev. No.	Date	Purpose	Prepared By	Reviewed By	Approved By

PROJECT INSTALLATION OF GTC AT GANDHAR		CLIENT GAIL	
UNIT New Compressor Area at Gandhar		JOB NO. B240	UNIT NO. 910
SUCTION PRESSURE	KG/CM2 G	36-39 (NOTE-2)	33 (NOTE-2)
SUCTION TEMPERATURE	DEG C	45-55	40-50
DISCHARGE PRESSURE	KG/CM2 G	92 (NOTE-16)	92 (NOTE-16)
DISCHARGE TEMPERATURE	DEG C	(NOTE-24)	(NOTE-24)
DEW POINT TEMPERATURE	DEG C	-103	-103
COMPRESSION RATIO		2.52 (NOTE-22)	2.74 (NOTE-22)
AFTER COOLER BY VENDOR		NO	NO
MAX DISCH. TEMP AT AFTER COOLER EXIT	DEG C		--
CONDENSATE FROM INTERSTAGES		--	REFER P&ID NO.
CAPACITY CONTROL			
MODE		AUTOMATIC	
RANGE FOR RECIPROCATING MACHINE(STEPS/S			
TYPE OF CONTROL			
AUTO START/AUTO STOP REQUIREMENT		AUTOSTOP REQUIRED	
MECHANICAL DATA			
UPSTREAM DESIGN PRESSURE	KG/CM2 G	92 (NOTE-17)	92 (NOTE-17)
UPSTREAM DESIGN TEMPERATURE	DEG C	75 (NOTE-17)	75 (NOTE-17)
DOWNSTREAM DESIGN PRESSURE	KG/CM2 G	92 (NOTE-17)	92 (NOTE-17)
DOWNSTREAM DESIGN TEMPERATURE	DEG C	NOTE-17	NOTE-17
UTILITIES AVAILABLE		MINIMUM	NORMAL
COOLING MEDIUM		AIR	MAXIMUM
TYPE		AIR COOLED	DESIGN
SUPPLY TEMPERATURE	DEG C		
SUPPLY PRESSURE	KG/CM2 G		
RETURN TEMPERATURE	DEG C		
RETURN PRESSURE	KG/CM2 G		
STEAM TURBINE DATA		NA	
INLET TEMPERATURE	DEG C		
INLET PRESSURE	KG/CM2 G		
OUTLET PRESSURE	KG/CM2 G		
SAFETY VALVE REQUIRED ON THE STEAM TURBINE EXHAUST		--	
STEAM CONDENSATE			
PRESSURE	KG/CM2 G		
INSTRUMENT AIR		NOTE-23	
TEMPERATURE	DEG C	AMB	65
PRESSURE	KG/CM2 G	4.5	6.0
NITROGEN		NOTE-18	6.5
TEMPERATURE	DEG C	40	9.5
PRESSURE	KG/CM2 G	3.0	4.0
REFERENCE P&ID (IF ANY)			

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PROJECT		INSTALLATION OF GTC AT GANDHAR		CLIENT GAIL	
UNIT	New Compressor Area at Gandhar			JOB NO.	B240 UNIT NO. 910
ITEM NO	910-K-901			CASE	CASE 2
SERVICE	NATURAL GAS COMPRESSOR				
TYPE	CENTRIFUGAL				
LOCATION	GANDHAR (UNDER ROOF)				
NO OF COMPRESSOR REQUIRED					
IN REGULAR USE	ONE				
AS SPARE	NONE				
LUBRICATING OR NON LUBRICATING TYPE					
TYPE OF DRIVER					
REGULAR COMPRESSOR	GAS TURBINE				
SPARE COMPRESSOR	NONE				
VARIABLE SPEED MOTOR REQUIRED	NO				
COMPRESSOR CONNECTED TO EMERGENCY POWER/STEAM	NO				
NUMBER OF STAGES	ONE (NOTE-22)				
OPERATION	CONTINUOUS				
PROPERTIES OF GAS(COMPOSITION AT SUCTION)					
COMPOSITION (MOLE %)	CASE-2A (NOTE-13,25,29)				
WATER VAPOUR	FULLY SATURATED				
HYDROGEN	-				
NITROGEN	0.16				
OXYGEN					
CARBON MONOXIDE	-				
CARBON DIOXIDE	2.47				
HYDROGEN SULPHIDE	0.00141				
METHANE	85.73				
ETHYLENE					
ETHANE	5.06				
PROPYLENE					
PROPANE	3.74				
I-BUTANE					
N-BUTANE	1.79				
I-PENTANE					
N-PENTANE	0.56				
HEXANE PLUS(AVERAGE M.WT.)	0.48				
AMMONIA					
HYDROGEN CHLORIDE					
CHLORINE					
INERTS(AVERAGE M.WT.)					
AIR(DRY BASIS)					
FLOW RATE FOR ONE COMPRESSOR	NM3/HR				
	KG/HR		123009-123264 (NOTE-1,2)		
AVERAGE M.WT.	WET BASIS		19.9163		
DENSITY	WET BASIS		20.15-23.56		
COMPRESSIBILITY FACTOR			0.9246-0.9393		
RATIO OF SPECIFIC HEATS (CP/CV)			1.345-1.384 (NOTE-21)		
CORROSIVE/EROSIVE ELEMENTS			NIL		
PARTICLE SIZE OF EROSIVES (IF ANY)					
IS DESIGN FOR NACE CODE IS REQUIRED	NO		NO	--	
LINE RATING					
SUCTION	600# (NOTE-19,20)				
DISCHARGE	900# (NOTE-19)				
OPERATING CONDITION					

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PROJECT INSTALLATION OF GTC AT GANDHAR		CLIENT GAIL	
UNIT New Compressor Area at Gandhar		JOB NO. B240	UNIT NO. 910
SUCTION PRESSURE	KG/CM2 G	25-28 (NOTE-2)	
SUCTION TEMPERATURE	DEG C	40-50	
DISCHARGE PRESSURE	KG/CM2 G	92 (NOTE-16)	
DISCHARGE TEMPERATURE	DEG C	(NOTE-24)	
DEW POINT TEMPERATURE	DEG C	-35	
COMPRESSION RATIO		3.58 (NOTE-22)	
AFTER COOLER BY VENDOR		NO	NO
MAX DISCH. TEMP AT AFTER COOLER EXIT	DEG C		--
CONDENSATE FROM INTERSTAGES		-- REFER P&ID NO.	
CAPACITY CONTROL			
MODE		AUTOMATIC	
RANGE FOR RECIPROCATING MACHINE(STEPS/S			
TYPE OF CONTROL			
AUTO START/AUTO STOP REQUIREMENT		AUTOSTOP REQUIRED	
MECHANICAL DATA			
UPSTREAM DESIGN PRESSURE	KG/CM2 G	92 (NOTE-17)	
UPSTREAM DESIGN TEMPERATURE	DEG C	75 (NOTE-17)	
DOWNSTREAM DESIGN PRESSURE	KG/CM2 G	92 (NOTE-17)	
DOWNSTREAM DESIGN TEMPERATURE	DEG C	NOTE-17	
UTILITIES AVAILABLE		MINIMUM	NORMAL
COOLING MEDIUM		AIR	
TYPE		AIR COOLED	
SUPPLY TEMPERATURE	DEG C		
SUPPLY PRESSURE	KG/CM2 G		
RETURN TEMPERATURE	DEG C		
RETURN PRESSURE	KG/CM2 G		
STEAM TURBINE DATA		NA	
INLET TEMPERATURE	DEG C		
INLET PRESSURE	KG/CM2 G		
OUTLET PRESSURE	KG/CM2 G		
SAFETY VALVE REQUIRED ON THE STEAM TURBINE EXHAUST		--	
STEAM CONDENSATE			
PRESSURE	KG/CM2 G		
INSTRUMENT AIR		NOTE-23	
TEMPERATURE	DEG C	AMB	65
PRESSURE	KG/CM2 G	4.5	6.0
NITROGEN		NOTE-18	
TEMPERATURE	DEG C	40	
PRESSURE	KG/CM2 G	3.0	4.0
REFERENCE P&ID (IF ANY)			
NOTES:			
1 CAPACITY INDICATED IS RATED CAPACITY OF COMPRESSOR i.e., CORRESPONDING TO 3.5 MMSCMD.			
2 SUCTION PRESSURE INDICATED IS AT THE SUCTION FLANGE OF THE COMPRESSOR.TEMPORARY STRIANER SHALL BE IN SUCTION LINE DURING START UP AND THE SAME SHALL BE REPLACED BY PERMANENT STRAINER SUBSEQUENTLY. STRAINER PRESSURE DROP OF 0.1 KG/CM2 HAS BEEN CONSIDERED TO ARRIVE AT THE COMPRESSOR SUCTION PRESSURE.			
3 VENDOR TO PROVIDE THE MESH SIZE AND THE PRESSURE DROP ACROSS THE PERMANENT STRAINER.			
4 VENDOR SHALL SUPPLY PERFORMANCE CURVES FOR ALL CASES OF OPERATION.			
5 VENDOR TO INCLUDE IN THE SCOPE OF SUPPLY ALL NORMAL INSTRUMENTATION AND CONTROL (INCLUDING ANTI SURGE CONTROL) FOR EFFICIENT OPERATION, SHUTDOWN AND SAFETY REQUIREMENTS AND ESSENTIAL ACCESSORIES.			
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PROJECT	INSTALLATION OF GTC AT GANDHAR			CLIENT	GAIL
UNIT	New Compressor Area at Gandhar			JOB NO.	UNIT NO.
6	APART FROM THE VENDORS SCOPE OF SUPPLY AS PER P&ID NO. B240-02-42-910-1112 & 1113, VENDOR SHALL SUPPLY ADDITIONAL INSTRUMENTATION, CONTROL & SHUTDOWN LOGIC DEVICES FOR SAFE AND EFFICIENT OPERATION OF MACHINE.			B240	910
7	AUTOMATIC SPILL BACK IS CONSIDERED FOR COMPRESSOR.				
8	COMPRESSOR WILL START FROM CONTROL PANEL LOCATED IN MAIN CONTROL ROOM, HOWEVER, START CLEARANCE FROM FIELD WILL BE PROVIDED. MONITORING & CONTROL OF THE COMPRESSOR STATION SHALL BE PERFORMED FROM DCS/PLC.				
9	VENDOR TO INDICATE UTILITY REQUIREMENT.				
10	VENDOR TO PROVIDE NECESSARY FILTER, ELECTRIC HEATER, PRESSURE REGULATOR, CONTROL VALVES ETC. FOR SEAL GAS SYSTEM.				
11	NORMAL AS WELL AS EMERGENCY SEAL GAS SUPPLY SHALL BE FROM COMPRESSOR DISCHARGE. EMERGENCY SEAL GAS SUPPLY PRESSURE SHALL BE 60 TO 92 KG/CM2G AT COMPRESSOR B/L. ENGG TO PROVIDE THE START-UP SEAL GAS FLOWRATE, PRESSURE AND TEMPERATURE REQUIREMENT AT COMPRESSOR B/L. ALSO ENGG TO PROVIDE NORMAL AND EMERGENCY SEAL GAS FLOWRATES REQUIREMENT. VENDOR TO PROVIDE FLOW INDICATION AND ALARM IN SEAL GAS SUPPLY LINE.				
12	ACCESSORIES LIKE INSTRUMENTATION AND CONTROL PANEL ARE IN VENDOR SCOPE OF SUPPLY.				
13	CASE-1 REPRESENTS WHILE GANDHAR GPU IS RUNNING CONDITION (NORMAL OPERATING CASE) CASE-2 REPRESENTS WHILE GANDHAR GPU IS STOPPED CONDITION.				
14	RLNG FROM 18INCH GANDHAR-JHANORE LINE SHALL BE USED FOR FUEL NORMALLY. RLNG WILL BE AVAILABLE AT PRESSURE ABOUT 38 KG/CM2G AND TEMPERATURE ABOUT 18-35 °C. LHV (KCAL/SM3) - 8445 TO 8834 SRG SHALL BE USED AS SECONDARY FUEL. SRG SHALL BE TAKEN FROM COMPRESSOR INLET COMMON HEADER AND BATTERY LIMIT CONDITIONS AT FUEL GAS CONDITIONING SKID SHALL BE SAME AS MENTIONED UNDER CASE-1 (NORMAL OPERATING CASE) & CASE-2. LHV (KCAL/SM3) - CASE-1: 8396.761; CASE-2: 9288.321 VENDOR SCOPE SHALL INCLUDE A SUITABLE FUEL GAS LETDOWN/BOOSTER/CONTROL SYSTEM ALSO.				
15	VENDOR TO PROVIDE MAX. RATE OF DEPRESSURISATION DURING COMPRESSOR TRIP/ESD.				
16	DISCHARGE PRESSURE INDICATED IS AT THE COMPRESSOR DISCHARGE FLANGE.				
17	DESIGN PRESSURE AND TEMPERATURE AT COMPRESSOR SUCTION, INTERMEDIATE STAGES (IF ANY) AND DISCHARGE TO BE PROVIDED/CONFIRMED BY ENGG/VENDOR				
18	VENDOR TO INDICATE NITROGEN REQUIREMENT FOR COMPRESSOR.				
19	INDICATED IS MINIMUM RATING. VENDOR TO CHECK AND CONFIRM THE SAME. TO BE FIRMED UP BY ENGINEERING.				
20	COMPRESSOR VENDOR TO FURNISH SETTLE OUT PRESSURE CALCULATION AND BLOW DOWN CALCULATIONS FOR REVIEW BY EIL.				
21	CP/ CV VALUE IS ESTIMATED FOR CALCUALTION PURPOSE, CP/ CV VALUE SHOULD BE USED FROM VENDOR COMPRESSOR DATA SHEET				
22	DATA SHEET HAS BEEN PREPARED CONSIDERING SINGLE STAGE. ENGG TO CONFIRM THE NUMBER OF STAGES, INTERSTAGE PRESSURE, TEMPERATURE AND COMPRESSION RATIO.				
23	INSTRUMENT AIR REQUIRMENT SHALL BE CONFIRMED BY GTC VENDOR				
24	ENGINEERING/VENDOR TO CONFIRM THE COMPRESSOR DISCHARGE TEMPERATURE				
25	COMPRESSOR SHALL BE RUNNING UNDER CASE-I FOR MOST OF THE TIME.				
26	VENDOR TO MENTION THE EMERGENCY POWER LOAD REQUIREMENT FOR COMPRESSOR AUXILIARIES.				
27	FOR CASE-1A OPERATION, PROCESS PARAMETERS AT EXTREME CONDITIONS AS FOLLOWS:				
	Suction Pressure, Kg/cm2g	36	36	39	39
	Suction Temperature, Degree C	45	55	45	55
	Flowrate, kg/hr	110121	110121	110121	110121
	Avg. Molecular weight, Dry Basis	17.8811	17.8811	17.8811	17.8811
	Density (Dry Basis), Kg/m3	26.4439	25.4284	28.7496	27.6263
	Compressibility Factor	0.9284	0.936	0.9231	0.9313
	Cp/Cv Ratio	1.3893	1.3731	1.3994	1.382
28	FOR CASE-1B OPERATION, PROCESS PARAMETERS AT EXTREME CONDITIONS AS FOLLOWS:				
	Suction Pressure, Kg/cm2g	33	33		
	Suction Temperature, Degree C	40	50		
	Flowrate, kg/hr	110121	110121		
	Avg. Mol. wt., Dry Basis	17.8811	17.8811		
	Density (Dry Basis), Kg/m3	24.6499	23.696		
	Compressibility Factor	0.9299	0.9374		
	Cp/Cv Ratio	1.3875	1.3717		

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UNIT	New Compressor Area at Gandhar	JOB NO.	B240
		UNIT NO.	910

29 FOR CASE-2A OPERATION, PROCESS PARAMETERS AT EXTREME CONDITIONS AS FOLLOWS:

Suction Pressure, Kg/cm2g	25	25	28	28
Suction Temperature, Deg.C	40	50	40	50
Flowrate, kg/hr	123044	123264	123009	123204
Avg. Mol.wt. (Wet Basis)	19.9163	19.9163	19.916	19.9163
Density (Wet Basis),Kg/m3	20.9548	20.1521	23.5599	22.6359
Compressibility Factor	0.9321	0.9393	0.9246	0.9326
Cp/Cv Ratio	1.3421	1.328	1.3539	1.3383

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