

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-1(NOTE-13,25,27)					2
WATER VAPOUR		NIL					
HYDROGEN		-					
NITROGEN		0.23					
OXYGEN							
CARBON MONOXIDE		-					
CARBON DIOXIDE		2.36					
HYDROGEN SULPHIDE		0.00141					
METHANE		90.35					
ETHYLENE							
ETHANE		5.93					
PROPYLENE							
PROPANE		1.06					
I-BUTANE							
N-BUTANE		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)					
AVERAGE M.WT.	DRY BASIS	17.88					
DENSITY	DRY BASIS	25.42-29.35					
COMPRESSIBILITY FACTOR		0.9185-0.936					
RATIO OF SPECIFIC HEATS (CP/CV)		1.3731-1.4089 (NOTE-21)					
CORROSIVE/EROSIVE ELEMENTS		NIL					
PARTICLE SIZE OF EROSIVES (IF ANY)							
IS DESIGN FOR NACE CODE IS REQUIRED		NO	--			--	
LINE RATING							
SUCTION		600# (NOTE-19,20)					
DISCHARGE		900# (NOTE-19)					
OPERATING CONDITION							
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				UNIT NO.		910	
SUCTION PRESSURE	KG/CM2 G	36-39 (NOTE-2)					
SUCTION TEMPERATURE	DEG C	40-55					
DISCHARGE PRESSURE	KG/CM2 G	92 (NOTE-16)					
DISCHARGE TEMPERATURE	DEG C	(NOTE-24)					
DEW POINT TEMPERATURE	DEG C	-103 (NOTE-30)					
COMPRESSION RATIO		2.52 (NOTE-22)					
AFTER COOLER BY VENDOR		NO		--		--	
MAX DISCH. TEMP AT AFTER COOLER EXIT	DEG C	55					
CONDENATE 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		MAXIMUM	
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		6.5	
NITROGEN		NOTE-18					
TEMPERATURE	DEG C			40			
PRESSURE	KG/CM2 G	3.0		4.0		9.5	
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-2 (NOTE-13,25,29)					2
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	122424-122965 (NOTE-1,2)				
AVERAGE M.WT.			WET BASIS	19.9163				
DENSITY			WET BASIS	KG/M3	21.38-26.249			
COMPRESSIBILITY FACTOR			0.8999-0.9282					
RATIO OF SPECIFIC HEATS (CP/CV)			1.3497-1.4022 (NOTE-21)					
CORROSIVE/EROSIVE ELEMENTS			NIL					
PARTICLE SIZE OF EROSIVES (IF ANY)								
IS DESIGN FOR NACE CODE IS REQUIRED			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	15-35	
DISCHARGE PRESSURE	KG/CM2 G	92 (NOTE-16)	
DISCHARGE TEMPERATURE	DEG C	(NOTE-24)	
DEW POINT TEMPERATURE	DEG C	-35 (NOTE-30)	
COMPRESSION RATIO		3.58 (NOTE-22)	
AFTER COOLER BY VENDOR		NO	--
MAX DISCH. TEMP AT AFTER COOLER EXIT	DEG C	55	
CONDENATE 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	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)			

NOTES:

- CAPACITY INDICATED IS RATED CAPACITY OF COMPRESSOR i.e., CORRESPONDING TO 3.5 MMSCMD.
- SUCTION PRESSURE INDICATED IS AT THE SUCTION FLANGE OF THE COMPRESSOR. TEMPORARY STRAINER 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.
- VENDOR TO PROVIDE THE MESH SIZE AND THE PRESSURE DROP ACROSS THE PERMANENT STRAINER.
- VENDOR SHALL SUPPLY PERFORMANCE CURVES FOR ALL CASES OF OPERATION.
- 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. B240-02-42-910-1111/1112/1113 & 1114, 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/NORMAL/EMERGENCY SEAL GAS FLOWRATES REQUIREMENT AT COMPRESSOR B/L. 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 28 to 30 KG/CM2G AND TEMPERATURE ABOUT 18-35 °C. LHV (KCAL/SM3) - 8445 TO 8834 DEW POINT - (-)68.75 DEGC AT 30 KG/CM2G REFER NOTE-31 FOR RLNG COMPOSITION IN MOLE%. 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. SELECTION OF GT SHALL BE BASED ON PRIMARY SOURCE OF FUEL i.e. RLNG FROM DVPL-I/II.				
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 CALCULATION 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 REQUIREMENT SHALL BE CONFIRMED BY GTC VENDOR				
24	ENGINEERING/VENDOR TO PROVIDE 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-1 OPERATION, PROCESS PARAMETERS AT EXTREME CONDITIONS AS FOLLOWS:				
	Suction Pressure, Kg/cm2g	36	36	39	39
	Suction Temperature, Degree C	40	55	40	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	26.9884	25.4284	29.353	27.6263
	Compressibility Factor	0.9242	0.936	0.9185	0.9313
	Cp/Cv Ratio	1.3981	1.3731	1.4089	1.382
28	DELETED				2
29	FOR CASE-2 OPERATION, PROCESS PARAMETERS AT EXTREME CONDITIONS AS FOLLOWS:				
	Suction Pressure, Kg/cm2g	25	25	28	28
	Suction Temperature, Deg.C	15	35	15	35
	Flowrate, kg/hr	122794	122965	122424	122940
	Avg. Mol.wt. (Wet Basis)	19.9163	19.9163	19.916	19.9163
	Density (Wet Basis), Kg/m3	23.3317	21.3845	26.2488	24.0558
	Compressibility Factor	0.9097	0.9282	0.8999	0.9202
	Cp/Cv Ratio	1.3849	1.3489	1.4022	1.3623
30	DEW POINT TEMPERATURE IS MENTIONED AT ATMOSPHERIC PRESSURE				

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UNIT	New Compressor Area at Gandhar	JOB NO.	B240
		UNIT NO.	910
31	REFER BELOW FOR RLNG COMPOSITION IN MOLE % BASED ON MINIMUM AND MAXIMUM LHV VALUES.		
	COMPONENT	MIN. LHV VALUE COMP.	MAX. LHV VALUE COMP.
	C1	93.32912	90.74001
	C2	5.62274	6.24112
	C3	0.27888	1.81558
	iC4	0.04775	0.32322
	nC4	0.05217	0.47376
	iC5	0.00333	0.01843
	nC5	0.00086	0.00487
	N2	0.66510	0.38304

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