

Unused Sulfuric Acid Plant



Contact

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1. Executive Summary

1.1 Plant Capacity

- Design capacity 1,500 TPD (as 100% acid)
- Minimum production capacity 650 TPD (as 100% acid)
- Heat Recovery System (HRS) produces 32 tons/hour of medium-pressure steam.
- The boiler produces 80 tons/hour of high-pressure steam.

1.2 Process Technology

- Provided by MECS
- Double catalysis – Double absorption process

1.3 Raw Material

- Liquid Sulphur 99.9% w/w (dry basis)
- Temperature 140 °C
- Ash 20 ppm (max)

1.4 Product

- Sulfuric acid concentration 98.5% (minimum)

1.5 Plant Reliability

- Conversion (yield) 99.8%
- Minimum 339 days per year of operation (26 days for scheduled maintenance).
Downtime of major turnaround: 3 weeks per 18 months

2. Process Description

The plant includes four process sections:

- Sulphur fusion / filtration
- Production of gaseous SO₂
- Catalytic oxidation of SO₂ to produce SO₃
- Absorption of SO₃ to produce sulfuric acid

Sulphur Dioxide (SO₂) Production The combustion of Sulphur is carried out with oxygen in a drying tower. The gas leaving the Sulphur furnace is cooled in a heat exchanger to the temperature required to convert SO₂ into SO₃.

Catalytic Oxidation of SO₂ Vanadium oxide is used as the catalyst to convert SO₂ to SO₃.

Absorption of SO₃ In the double absorption tower with ceramic rings, SO₃ reacts with water to form concentrated sulfuric acid.

2.1 Melting, Filtration and Storage of Molten Sulphur - Unit 610

The solid Sulphur is deposited to a hopper and then transferred by a conveyor to the melting tank which is heated at 135 °C by medium pressure (9 bar) steam. The molten Sulphur is then filtered to remove impurities such as ash, dust, bitumen, etc. The filtered Sulphur is kept in liquid phase by low pressure (4 bar) steam. This is a batch process. The unit has capacity to process 506.5 tons/day of solid Sulphur in 16 hours.

There are two filtration pits. The first receives the Sulphur directly from the melting tank and the second prepares the filtration prelayer. Approximately 20 – 30 Kg of diatomaceous earth and 25 Kg of lime are added to the second pit and circulate for ½ - ¾ hours to form the prelayer. As soon as the prelayer is formed, the Sulphur pump starts to filter the dirty liquid and sends the filtered Sulphur to the polish filter. When the filtration is complete, the pumps are insulated and the filters and pipes are drained to the pit. The filtered Sulphur liquid goes to the storage tank.

2.2 SO₂ Formation and SO₃ Conversion - Unit 620

In a combustion chamber, the Sulphur burns in the presence of air to form sulfur dioxide (SO₂). Atmospheric air is drawn in through a filter and compressed by the blower to pass through the rest of the installation. It first crosses the drying tower in which it encounters a flow of 98.5% sulfuric acid which removes the moisture it contains. The flow of acid flowing over the drying tower is kept sufficient so that the concentration of acid leaving the tower is not reduced too significantly. The temperature of the gas leaving the combustion chamber is much higher than that required for entering the converter. For this, the gas is cooled in a recovery boiler allowing the production of saturated HP vapor. At the outlet of the boiler, the gas enters the first catalysis pass.

A drying tower is used to remove moisture from the air before it enters to the oxidation reaction. The oxidation reactor is set to convert 99.8% of SO₂ to SO₃ in 4 catalytic passes. The main superheater cools the partially converted gas leaving the first pass of the converter, recovering the heat to superheat the HP vapor produced (and thus avoid water hammer in the steam pipes). The cooled gas then enters the second pass of the converter in which the conversion reaction continues and generates heat. The gas leaving the second pass is cooled in the hot gas-gas exchanger, before being directed to the third pass in which the reaction still continues. At the exit of the third pass, the gas is partially cooled in the cold gas-gas exchanger. The second economizer beam (device generally called interpass economizer) provides additional cooling by heating the feed water to the HP boiler which comes from the first economizer beam, itself located at the bottom of the final economizer. The acid product is produced by combining SO₃ with the water contained in the circulating acid. The process has 278 ppm of SO₂ discharge to the chimney.

After passing through the fourth pass, the process gas is successively cooled in the primary steam superheater HP, the steam superheater MP, the third economizer beam and the first economizer beam. The bundles of these four devices are placed one below the other in the same gas-side grille, which is generally called the final economizer and in which the gas flows vertically from top to bottom. The HP primary steam superheater slightly overheats the saturated steam leaving the HP boiler, the MP steam superheater overheats the MP steam leaving the HRS boiler, the third and first economizer bundles preheat the feed water to the HP boiler. At the outlet of the final economizer, the gas is directed to the final absorption tower, in which the remainder of SO₃ is absorbed in a counter current of 98.5% acid. The demister located at the top of the final absorption tower collects the acid droplets entrained in the gas before it is released into the atmosphere through the chimney. The demister units are designed to comply with atmospheric discharge standards.

2.3 Absorption of SO₃ in Sulfuric Acid and Heat Recovery – Unit 630

The SO₃ gas, even if properly cooled, cannot combine directly with H₂O water to give H₂SO₄ (the heat generation would be too great and dangerous). It must be combined indirectly with the water contained in the 99.0 and 98.5% acids circulating on the HRS and final absorption towers. The concentration and temperature of the acid circulating in the drying towers, HRS and final absorption, must be kept within certain limits to ensure the most efficient absorption of SO₃ and atmospheric water vapor. The acid watering the drying tower is diluted by the absorption of water vapor contained in the air. The acids watering the HRS and final absorption towers see increase its concentration by the absorption of SO₃ gas. The acids leaving the drying and final absorption towers are collected in a common tank in which dilution water is added to maintain the titer of the acid. The acid must be stored below 45°C to limit corrosion of the tanks.

The heat recovery system recovers the heat of absorption of SO₃ coming from the third pass of the converter to produce MP (Medium Pressure) steam. In the HRS tower, the heat of absorption of SO₃ is recovered in the first stage. At the second stage, the residual SO₃ and the sulfuric acid vapors are recovered. It eliminates the heat of absorption of the residual SO₃, the heat of condensation of the sulfuric acid vapors as well as the sensible heat of the gas.

The gas rises vertically in the HRS tower and the SO₃ is absorbed through a 99.0% sulfuric acid counter-current falling flow. The recommended maximum concentration for circulating HRS acid is 99.7%. The gas leaving the HRS tower passes through a demister installed on the top of the tower and is directed to the cold gas-gas exchanger. The demister is intended to protect the equipment located downstream from the HRS tower.

The HP steam system generates steam at 64 bar and 425 °C; the MP steam is 9 bar and 220 °C.

2.4 Steam Generation - Unit 640

The temperature of the combustion gas leaving the furnace is higher than that required by the conversion system. The gas is cooled in the main boiler which recovers excess heat to produce

high-pressure steam. The temperature of the gas at the entrance to the conversion is adjusted using a gas-side boiler bypass. The temperature of the steam at the exit of the boiler depends only on the pressure in the boiler.

Two HP superheaters operate in series to overheat HP steam to 425 °C. The temperature of the HP steam coming out of the unit is first controlled by the steam side bypass of the primary superheater. If the temperature is still too high with this wide open bypass, then the de-heater located between the two is used. The temperature of the MP steam is adjusted by the steam side bypass of the MP steam superheater.

2.5 Steam Distribution & Utilization - Unit 650

This unit manages the steam produced in the sulfuric acid production by distributing it to three utilizations:

- Generate electricity
- Melt and keep liquid sulphur at designed temperature
- Maintain the temperature at the entrance of the absorption tower

HP (60 bar, 450 °C, 80 t/h) and MP (9 bar, 220 °C, 23 t/h) steams are mainly used to generate electricity by the steam generator (max 23.3 MW). Some of the MP steam and all the LP (4 bar 152 °C) steam are used for process Unit 610 Melting Sulphur and Unit 630 Absorption.

2.6 Boiler Water & Condensate - Unit 660

This unit prepares boiler water from the condensates of the acid production unit by doing the following tasks:

- Collect condensates
- Generate boiler water
- Distribute the water to boiler

3. Major Equipment

3.1 Melting, Filtration and Storage of Molten Sulphur - Unit 610

610-CV-1000	Sulphur belt conveyor
610-BN-1010	Sulphur loading bin
610-MG-1030	Sulphur tramp iron magnet
610-WS-1020	Sulphur belt scale
610-BN-1110	Lime loading bin
610-WS-1120	Lime dosing screw
610-ZM-1140	Lime chute
610-TK-2000	Sulphur melting tank

610-AG-2020	Sulphur melting tank agitator
610-TK-3000	Melted Sulphur pit
610-HE-3010 & 3018	Melted Sulphur pit heating coils
610-AG-3020 & 3022	Melted Sulphur pit agitators
610-PU-3040	Filter feed pump
610-FL-4000	Sulphur filter
610-FL-4100	Polishing filter
610-TK-5000	Filtered Sulphur tank
610-PU-5030 A&B	Furnace feed pumps

3.2 SO₂ Formation and SO₃ Conversion - Unit 620

620-FC-1000	Sulphur Furnace
620-BU-1010	Sulphur Guns
620-BU-1020	Start-up Burner
620-RE-2000	Converter
620-HE-2200	Cold Interpass Heat Exchanger
620-HE-2100	Hot Interpass Heat Exchanger
620-ST- 3000	Exhaust Stack
620-TV-2000-21	Main Superheater
620-TV-2000-31	Hot Gas-Gas Exchanger
620-TV-2000-41	Cold Gas-Gas Exchanger

3.3 Absorption of SO₃ - Unit 630

630-BL-1000	Main Blower
630-FL-1010	Air Inlet Filter
630-CM-3000	Absorption Tower (commonly referred as Heat Recovery Tower)
630-CM-2000	Drying Tower
630-CM-4000	Final Absorption Tower
630-TK-5000	Common Acid Pump Tank
630-PU-5010	Common Acid Circulating Pump
630-PU-6000 A/B	Product Pumps
630-HE-2100	Main Acid Cooler
630-HE-6100	Product Cooler
630-DL-7200	Diluter
630-HE-3100	HRS Acid Cooler
630-GP-7000	HRS boiler
630-DL-7200	HRS Diluter
630-HE-7300	Heater
630-HE-7400	Preheater

3.4 Steam Generation – Unit 640

640-GP-2000	Main Boiler
640-HE-5000 & 5100	HP Steam Superheater I & II
640-HE-5200	MP Steam Superheater
640- HE-6000	Primary Economizer
640-HE-6100	Intermediate Economizer
640-HE-6200	Final Economizer

3.5 Steam Distribution and Utilization - Unit 650

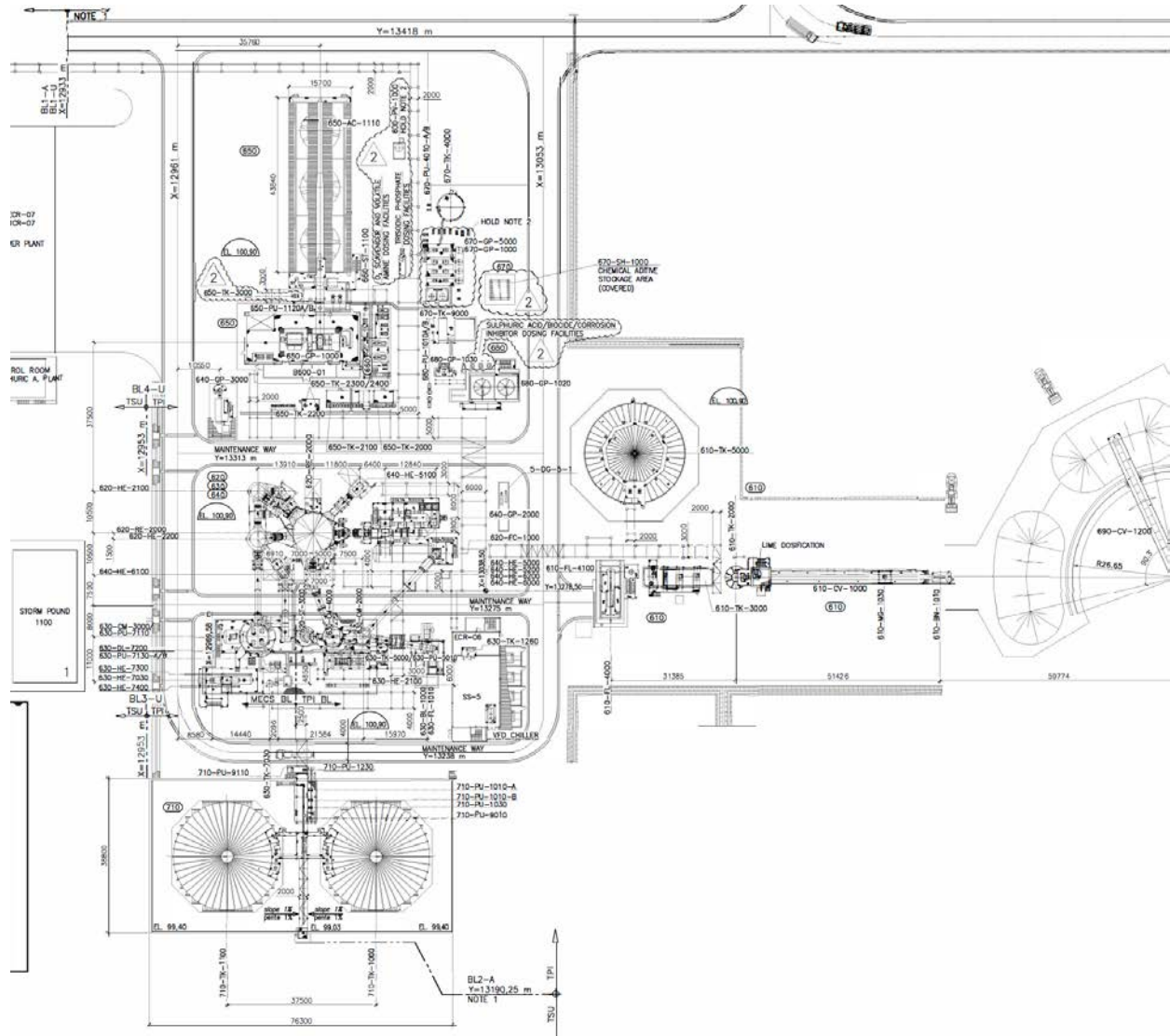
650-GP-1000	Electric Generator
650-TG-1100	Steam Turbine (20.7 MW, Max 24 MW)
650-AC-1110 A/B/C	Air Condensers
650-PU-1120-A/B	Condense Pumps
650-ED-1400A/B, 1410A/B, 1420	Ejectors
650-TK-1130	Condensate Tank
650-TK-2000	High-Pressure steam Header (Dia: 0.6 m, L 6.4 m, 60-64 barg)
650-TK-2100	Medium-Pressure Steam Header (Dia: 0.75 m, L 8.0 m, 9 barg)
650-TK-2200	Low-Pressure Steam Header (Dia: 0.4 m, L 6.2m, 4 barg)
650-TK-2300	MC Flash Tank (Dia: 0.6 m, L 2.2 m)
650-TK-2400	HP Condensate Flash Tank (Dia: 0.6 m, L 2 m)

3.6 Boiler Water & Condensate - Unit 660

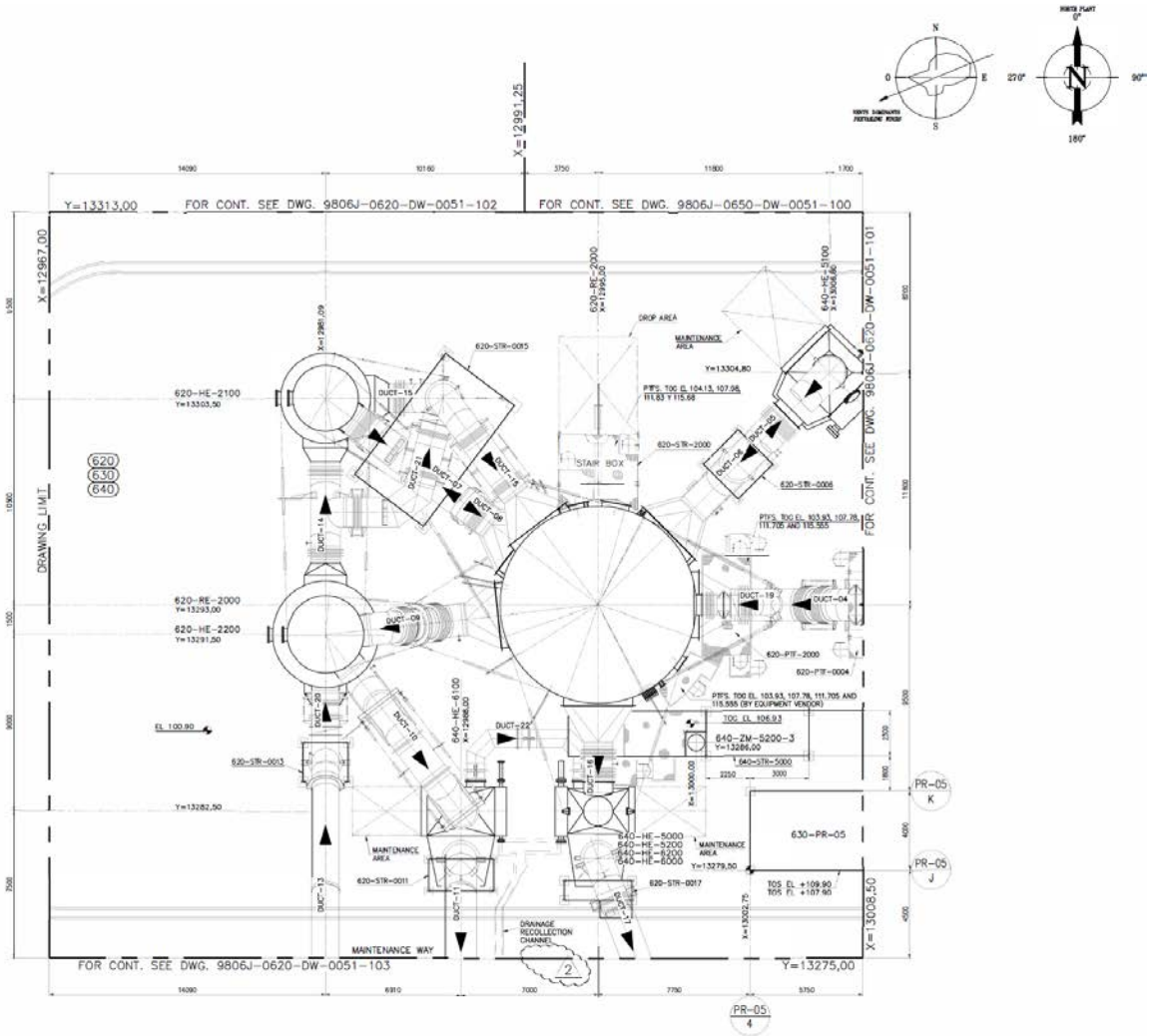
660-ST-1100	Exhaust Stack (Diam. 2.0m; top. 25m)
660-HE-2100	Thermal Deaerator
660-TK-2000	Boiler Feed Water Tank (Diam. 3.0m; Long. 9.2m)
660-TK-5000	Condensate Buffer Tank (Diam. 1.1m; Long. 3.0m)
660-PU-2010-A/B	Main Boiler Feed Pumps
660-PU-2020-A/B	De-superheating pumps
660-PU-2030-A/B	HRS and Auxiliary Boiler Pumps
660-GP-3000 O2	Oxygen scavenger Package
660-GP-6000	Volatile Amine Package
660-GP-4000	Trisodium Phosphate Package
660-TK-1000	Condensate Tank (Diam. 0.9 m; Long. 2.0 m)
660-PU-1010-A/B	Boiler Feed Water Tank

4. Plant Plot Plan

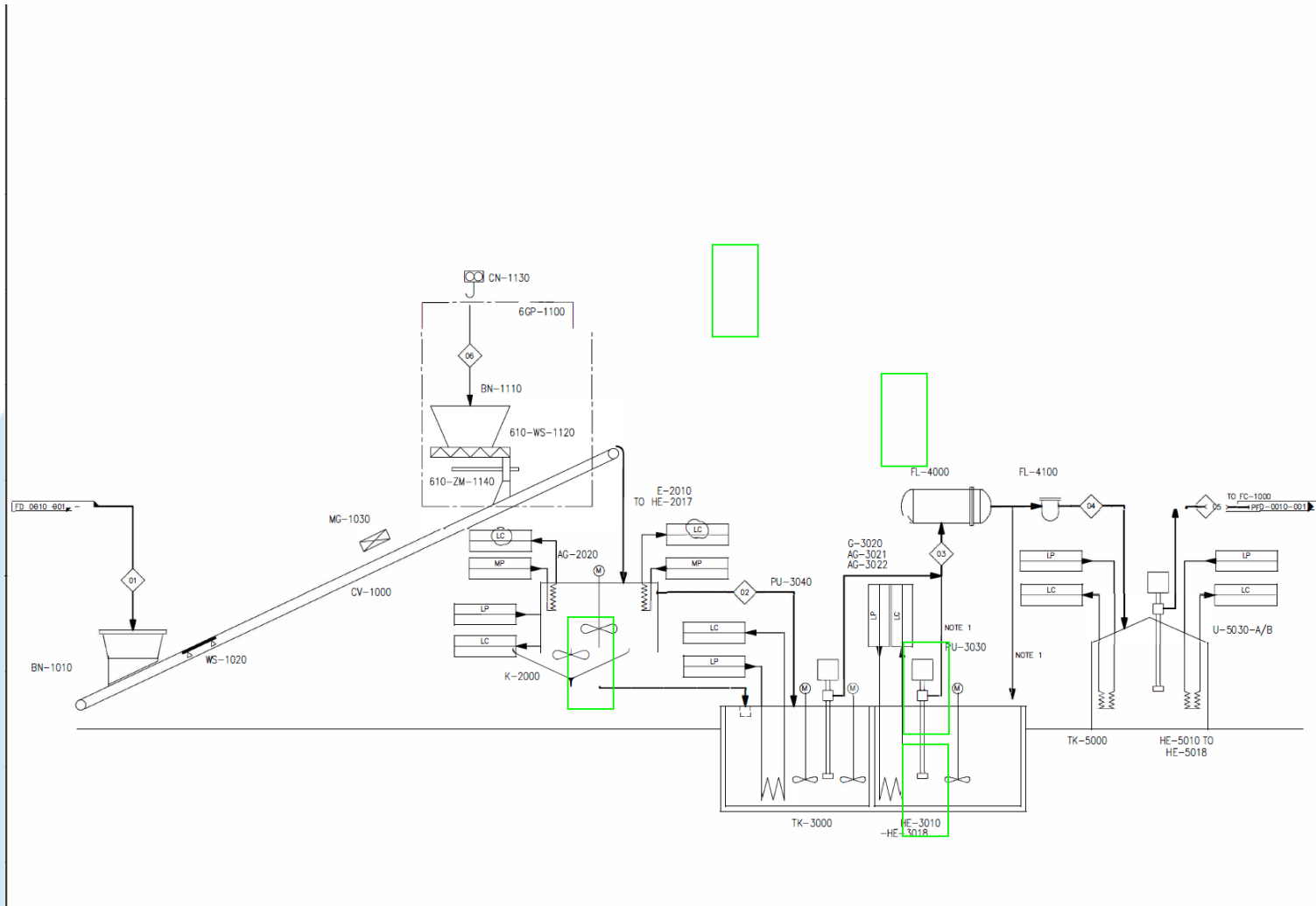
4.1 Entire Plant



4.2 Conversion Unit



5. Process Flow Diagram - Sulfur Melting, Filtration and Storage



GE Steam Turbine Data Sheet

STEAM TURBINE DATA SHEET SI UNITS		PROJECT TITLE _____											
		PROJECT SUB-TITLE _____ SULPHURIC ACID PLANT _____											
		Project N°	Unit	Document Code	Serial N°	Rev	Page						
		650			001	1	2						
1	APPLICABLE TO: <input type="radio"/> PROPOSAL <input checked="" type="radio"/> PURCHASE <input type="checkbox"/>		ITEM _____										
2	FOR _____		UNIT _____		MR _____								
3	SITE _____		SERIAL NUMBER _____										
4	SERVICE _____		NUMBER REQUIRED		1								
5	MANUFACTURER <u>GE Thermodyn</u> MODEL <u>6-8 MC 8 IN</u>		DRIVEN EQUIPMENT ITEM NO. _____										
6	DRIVEN EQUIPMENT TYPE: <input type="radio"/> COMPRESSOR <input checked="" type="radio"/> GENERATOR <input type="radio"/> OTHER _____												
7	NOTE: INFORMATION TO BE COMPLETED BY: <input type="radio"/> PURCHASER <input type="checkbox"/> MANUFACTURER <input checked="" type="checkbox"/> PURCHASER OR MANUFACTURER												
PERFORMANCE (Refer to SPECIFICATION 1TV0020NT2110)													
9	OPERATING POINTS		SHAFT		INLET		INDUCTION		EXHAUST				
10	<input checked="" type="checkbox"/> AS APPLICABLE		POWER	SPEED	FLOW	PRESS	TEMP	FLOW	PRESS	TEMP	PRESS	TEMP	ENTHALPY
11			kW	r/min	kg/h	Barg	°C (TT)	kg/h	Barg	°C (TT)	Bara	°C (TT)	kcal/kg
12													
13	RATED		23300	5700	84300	64	450	23400	9.3	242	0.15	55.4	571.6
14	NORMAL		20470	5700	80300	60	416	18800	9	223	0,2	61,2	566,8
15	MINIMUM		7010	5700	34500	60	400	0			0.15	54	565.9
16													
17	<input checked="" type="checkbox"/> STEAM RATE, kg/kWh (3.45): <u>3.923</u> NORMAL <u>3.570</u> RATED		INDUCTION		<input checked="" type="radio"/> CONTROLLED <input type="radio"/> UNCONTROLLED								
18	<input type="checkbox"/> POTENTIAL MAXIMUM POWER (3.30)		EXTRACTION		<input type="radio"/> CONTROLLED <input type="radio"/> UNCONTROLLED								
STEAM CONDITIONS (Refer to Performance Table)													
20			<input checked="" type="checkbox"/> INLET		<input type="checkbox"/> EXHAUST		<input checked="" type="checkbox"/> INDUCTION		<input type="checkbox"/> EXTRACTION		<input checked="" type="checkbox"/> EXTRACTION		<input type="checkbox"/> INDUCTION
21													
22	FLOW kg/h	MAXIMUM	84300				23400						
23		NORMAL	80300				18800						
24		MINIMUM					0						
25	PRESSURE Barg	MAXIMUM	64				9,3						
26		NORMAL	60				9						
27		MINIMUM					8,7						
28	TEMPERATURE °C (TT)	MAXIMUM	450				242						
29		NORMAL	416				242						
30		MINIMUM	400				223						
SITE AND UTILITY DATA													
32	LOCATION:				ELECTRIC: DRIVERS HEATING INSTRUMENT/ ALARM/ CONTROL SHUTDOWN								
33	<input checked="" type="radio"/> INDOOR <input type="radio"/> HEATED <input type="radio"/> UNDER ROOF <input type="radio"/> OUTDOOR				VOLTS <u>690</u> <u>230</u> _____ _____								
34	<input type="radio"/> UNHEATED <input type="radio"/> PARTIAL SIDES <input type="radio"/> GRADE <input checked="" type="radio"/> MEZZANINE				PHASE <u>3</u> <u>1</u> _____ _____								
35	<input type="radio"/> OTHER: _____				HERTZ <u>50</u> <u>50</u> _____ _____								
36	<input type="radio"/> WINTERIZATION REQUIRED <input checked="" type="radio"/> TROPICALIZATION REQ'D				kW AVAILABLE _____ _____ _____ _____								
37	<input type="radio"/> LOW TEMPERATURE <input type="radio"/> CORROSIVE AGENTS				COOLING WATER:								
38	<input checked="" type="radio"/> ELECTRICAL AREA CLASSIFICATION:				INLET TEMPERATURE: <u>31</u> °C MAX RETURN <u>41</u> °C								
39	CLASS _____ GROUP _____ DIVISION <u>Safe</u>				PRESS. NORM.: <u>4</u> Barg DESIGN _____ <u>7,5</u> Barg								
40	ZONE _____ GROUP _____ TEMPERATURE RATING: _____				MINIMUM RETURN PRESSURE: _____ <u>3</u> Barg								
41	SITE DATA:				MAXIMUM ALLOWABLE PRESS. DROP: _____ <u>1</u> Barg								
42	<input type="radio"/> ELEVATION <u>425</u> m <input type="radio"/> BAROM. PRESS <u>1,023</u> Bara				WATER SOURCE _____								
43	<input checked="" type="radio"/> WINTER TEMP. <u>5</u> °C SUMMER TEMP. <u>47</u> °C				VELOCITY, m/s: MIN _____ MAX _____								
44	<input checked="" type="radio"/> REL. HUMIDITY <u>15 - 40</u> % DESIGN WET BULB _____ °C				FOULING FACTOR: _____ <u>0,00033</u> m ² K/kW								
45	<input type="radio"/> UNUSUAL CONDITIONS: <input checked="" type="radio"/> DUST <input type="radio"/> FUMES				<input type="radio"/> UTILITY CONSUMPTION:								
46	<input checked="" type="radio"/> OTHER <u>Sulphuric acid plant</u>				COOLING WATER: _____ m ³ /h INST. AIR _____ m ³ /h								
47	UTILITY CONDITIONS:				AUX. STM: NORMAL _____ kg/h MAXIMUM _____ g/h								
48	<input checked="" type="radio"/> AUXILIARY STEAM: (10) MAX NORM MIN				AUX. DRIVERS: ELECTRIC _____ kW STEAM _____ kW								
49	INITIAL PRESS. (Barg) _____ <u>9,3</u> <u>9</u> <u>8,7</u>				HEATER(S): _____ kW OTHER: _____								
50	INITIAL TEMPERATURE, °C (TT) _____ <u>225</u> _____												
51	EXH. PRESS. (Barg) _____ _____ _____												
52	INST. AIR (Barg) NORM <u>7</u> MIN <u>3,5</u> MAX <u>10</u>												
53	INSTRUMENT AIR DEW POINT: <u>-5</u> °C												
54	REMARKS:												
55	(10) Steam for steam seal system (211 kg/h during start-up and 141 kg/h for continuous operation, design flow 633 kg/h)												
56													
57													
58													
59													
60													

		PROJECT TITLE _____						
		PROJECT SUB-TITLE _____ SULPHURIC ACID PLANT _____						
STEAM TURBINE		Project N°	Unit	Document Code	Serial N°	Rev	Page	
DATA SHEET		650			001	0	3	
SI UNITS								
1	APPLICABLE SPECIFICATIONS:			NOISE SPECIFICATIONS:				
2	● OTHER IEC 45-1 _____			● APPLICABLE TO MACHINE:				
3	● VENDOR HAVING UNIT RESPONSIBILITY : _____			SEE SPECIFICATION: _____				
4	○ GOVERNING SPECIFICATION, IF DIFFERENT: _____			○ APPLICABLE TO NEIGHBORHOOD: _____				
5				SEE SPECIFICATION: _____				
6				ACOUSTICAL TREATMENT ● YES ○ NO				
7				TYPE <u>Rock hool</u> _____				
8								
9	CONSTRUCTION FEATURES							
10	TURBINE TYPE ○ BACKPRESSURE ● CONDENSING ● INDUCTION ○ EXTRACTION ○ OTHER							
11	■ SPEEDS:			■ TORSIONAL CRITICAL SPEEDS (9.5):				
12	MAXIMUM CONTINUOUS <u>5700</u> r/min TRIP <u>6270</u> r/min			FIRST CRITICAL _____ 1020 r/min				
13	MAXIMUM ALLOWABLE _____ r/min			SECOND CRITICAL _____ 2640 r/min				
14	■ LATERAL CRITICAL SPEEDS (DAMPED)			THIRD CRITICAL _____ 8880 r/min				
15	FIRST CRITICAL <u>3180</u> r/min _____ rigid _____ MODE			FOURTH CRITICAL _____ 13860 r/min				
16	SECOND CRITICAL <u>8860</u> r/min _____ conical _____ MODE			● LATERAL ANALYSIS REPORT REQUIRED				
17	THIRD CRITICAL _____ r/min _____ MODE			● INDIVIDUAL BODY ○ TRAIN				
18	FOURTH CRITICAL _____ r/min _____ MODE			○ UNDAMPED STIFFNESS MAP REQUIRED (9.2.3.b)				
19	■ VIBRATION see 1TV0020NT201 _____ μm (PEAK TO PEAK)			● TRAIN TORSIONAL ANALYSIS REPORT REQUIRED (9.5.1)				
20	Lateral critical speed analysis			■ TRAIN TORSIONAL PERFORMED BY Turbine Vendor				
21	□ CASINGS, NOZZLES & DIAPHRAGMS							
22	■ MAWP			■ HYDRO TEST PRESSURE :				
23	INLET SECTION <u>74</u> (Barg) EXH. SECTION <u>0,7</u> (Barg)*			HP CASING <u>124</u> (Barg) MID CASING <u>70/45/28/18/7/3</u> (Barg)*				
24	INDUCTION/EXTRACT. SECTION _____ 12 (Barg)*			EXHAUST CASING <u>3</u> (Barg) OTHER _____ (Barg)*				
25	OTHER _____ (Barg)*			● WELDED NOZZLE RING NOZZLE RING <u>50</u> %ADM.				
26	■ MAX ALLOWABLE TEMP.			DIAPHRAGM BLADE ATTACH.: □ INTEGRALLY CAST				
27	INLET SECTION <u>450</u> °C EXHAUST SECTION _____ 100 °C			■ WELDED □ OTHER _____				
28	INDUCTION/EXTRACTION SECTION _____ 300 °C			DIAPHRAGM AXIAL LOCATION: ■ INDIVIDUALLY □ STACKED				
29	● MINIMUM DESIGN METAL TEMPERATURE (impact test) <u>20</u> °C			*UNLESS OTHERWISE SPECIFIED, ALL PRESSURE UNITS ARE GAUGE				
30	● RELIEF VALVE SETTING: INLET <u>74</u> (Barg)							
31	EXTRACTION _____ (Barg) OTHER (Induction) <u>12</u> (Barg)							
32	CASING CONNECTIONS							
33	CONNECTION	□ SIZE	■ FACING	● POSITION	■ FLANGED	○ MATING FLG. & GASKET BY VENDOR	□ MAXIMUM STEAM FLOW kg/h	
34							□ MINIMUM STEAM FLOW kg/h	
35								
36								
37	INLET	8"	900 # RTJ	Right	Flanged			
38	EXHAUST		FF	Down	Flanged			
39	EXTRACTION							
40	INDUCTION	8"	300 # RF	Down	Flanged			
41								
42	AUX. SCRWD. PIPE CONN.: ○ TAPERED ○ STRAIGHT ○ MAIN CASING JOINT STUDS/NUTS DESIGNED FOR HYD. TENSIONING							
43	■ ALLOWABLE FORCES & MOMENTS NEMA SM 23 3 times NEMA					ROTATION: (VIEWED FROM INLET END)		
44	PARALLEL TO SHAFT	INLET		EXHAUST		EXTRACT./INDUCT.		○ CW ● CCW
45		FORCE	MOMENT	FORCE	MOMENT	FORCE	MOMENT	
46		N	N-m	N	N-m	N	N-m	
47		VERTICAL						
48	HORZ. 90°							
49								
50								
51								
52								

STEAM TURBINE DATA SHEET SI UNITS		PROJECT TITLE _____					
		PROJECT SUB-TITLE <u>SULPHURIC ACID PLANT</u>					
		Project N°	Unit	Document Code	Serial N°	Rev	Page
			650		001	0	6

1	ACCESSORIES					
2	COUPLINGS AND GUARDS					
3	NOTE: SEE ROTATING ELEMENTS-SHAFT ENDS					
4	<input type="radio"/> SEE ATTACHED DATA SHEET					
5	COUPLING FURNISHED BY <u>GE Thermodyn</u>					
6	<input checked="" type="checkbox"/> MANUFACTURER	<u>Euroflex</u>	TYPE	<u>Flexible</u>	MODEL <u>8GH-330-S</u>	
7	COUPLING GUARD FURNISHED BY <u>GE Thermodyn</u>					
8	TYPE <input checked="" type="radio"/> FULLY ENCLOSED <input type="radio"/> SEMI OPEN <input type="radio"/> OTHER _____					
9	COUPLING DETAILS					
10	<input type="checkbox"/> MAXIMUM OUTER DIAMETER	<u>446 mm</u>	<input checked="" type="checkbox"/> VENDOR MOUNT HALF COUPLING			
11	<input type="checkbox"/> HUB MASS	<u>92,5 kg</u>	<input type="radio"/> MASS SIMULATOR	<input type="radio"/> IDLING ADAPTER REQUIRED		
12	<input type="checkbox"/> SPACER LENGTH	<u>888,6 mm</u>	LUBRICATION REQUIREMENTS			
13	<input type="checkbox"/> SPACER MASS	<u>65 kg</u>	<input type="radio"/> GREASE	<input type="radio"/> CONT. OIL LUBE	<input checked="" type="radio"/> NONE	
14	<input type="checkbox"/> QUANTITY PER HUE _____ kg OR m ³ /h					
15	MOUNTING PLATES (15.3)					
16	BASEPLATES FURNISHED BY: <u>GE Thermodyn</u>		SOLEPLATES FURNISHED BY: <u>GE Thermodyn</u>			
17	<input type="radio"/> UNDER TURBINE ONLY <input checked="" type="radio"/> OTHER <u>Turbine & Gear</u>		THICKNESS _____ <u>10 mm</u>			
18	<input type="radio"/> OPEN <input type="radio"/> NON-SKID DECKING <input type="radio"/> DRIP RIM		<input type="radio"/> SUBPLATES REQUIRED			
19	<input checked="" type="radio"/> LEVELING PADS <input type="radio"/> SUITABLE FOR OPTICAL ALIGN		<input type="radio"/> HOLD-DOWN BOLTS FURNISHED BY: _____			
20	<input type="radio"/> SINGLE SECTION <input type="radio"/> MULTI-SECTION		<input type="radio"/> EPOXY PRIMER VENDOR			
21	<input type="radio"/> COLUMN MOUNTING <input type="radio"/> SUBPLATES REQ'D		_____			
22	<input checked="" type="radio"/> LEVELING (CHOCK) BLOCKS REQ'D SUPPLIED BY: <u>GE Thermodyn</u>		<input checked="" type="radio"/> ANCHOR BOLTS FURNISHED BY: <u>GE Thermodyn</u>			
23	GEAR UNIT					
24	FURNISHED BY: <u>Ge Thermodyn</u> <input checked="" type="radio"/> REFERENCE API 613 <input type="radio"/> OTHER <u>Standard Manufacturer</u>					
25	SEE ATTACHED GEAR DATA SHEETS <u>See doc</u>					
26	CONTROL AND INSTRUMENTATION (12)					
27	INSTRUMENTS AND CONTROL PANELS SHALL BE <input type="radio"/> API 614, PAGES _____					
28	IN ACCORDANCE WITH THE FOLLOWING <input type="radio"/> API _____ 670, _____ PAGES					
29	ATTACHED DATA SHEETS: <input checked="" type="radio"/> Applicable specification : 9806J					
30						
31	PROTECTIVE DEVICES					
32		EXHAUST RELIEF VALVE	INDUCTION RELIEF VALVE	VACUUM BREAKER	SHUT OFF VALVE(S) INDUCTION	THERMAL RELIEF VALVE(S)
33						
34						
35	MOUNTING LOCATION	<u>Air Cooled Condenser</u>	<u>MP Steam</u>		<u>MP Steam</u>	
36	SET RELIEF PRESSURE, Barg	<u>0,44</u>	<u>12</u>		<u>12</u>	
37	CAPACITY, kg/h STEAM		<u>18800</u>		<u>18800</u>	
38	VALVE MANUFACTURER		<u>Consolated valve</u>		<u>ADAMS</u>	
39	VALVE TYPE	<u>Rupture disc</u>	<u>1910-00TT-4-CC</u>		<u>MAK B6</u>	
40	VALVE SIZE/RATING		<u>8" / 300#</u>		<u>8" / 150#</u>	
41	FLANGE FACING (FF, RF)		<u>RF</u>		<u>RF</u>	
42	FURNISHED BY	<u>Others</u>	<u>GE Thermodyn</u>		<u>GE Thermodyn</u>	
43	QUANTITY	<u>1</u>			<u>2</u>	
44	TAG NO	<u>PSE 1110-9</u>				
45	REMARKS: _____					
46	_____					
47	_____					
48	_____					
49	_____					
50	_____					

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<input checked="" type="radio"/> TRIP <input type="radio"/> TRIP & THROTTLE VALVES <input type="radio"/> DUPLICATE TRIP/TRIP AND THROTTLE VALVES REQUIRED	
<p>2 LOCATION: <input checked="" type="radio"/> MAIN INLET <input type="radio"/> INDUCTION</p> <p>3 PROVIDED BY: <input checked="" type="radio"/> VENDOR <input type="radio"/> PURCHASER</p> <p>4 <input checked="" type="checkbox"/> MANUFACTURER Thermodyn MODEL 8-900</p> <p>5 <input checked="" type="checkbox"/> SIZE 8" RATING 900 # FACING RTJ</p> <p>6 <input type="checkbox"/> SIZE _____ RATING _____ FACING _____</p> <p>7 <input type="checkbox"/> SIZE _____ RATING _____ FACING _____</p> <p>8 CONSTRUCTION FEATURES: INLET INDUCT.</p> <p>9 RESET: <input type="radio"/> MANUAL <input checked="" type="radio"/> HYDRAULIC</p> <p>10 TRIP: <input checked="" type="radio"/> LOCAL (MANUAL) <input checked="" type="radio"/> REMOTE</p> <p>11 EXERCISER: <input type="radio"/> LOCAL (MANUAL) <input type="radio"/> REMOTE</p> <p>12 <input checked="" type="radio"/> FULLY OIL OPERATED</p>	<p><input checked="" type="checkbox"/> STRAINER: OPENING SIZE _____ Built in (mm/MESH)</p> <p>MATERIAL A 387 Grade 22 Class 2</p> <p><input type="radio"/> TEMPORARY START-UP STRAINER _____ (MESH)</p> <p>MATERIAL _____</p> <p><input type="checkbox"/> STEM MATERIAL _____ HARDNESS _____ HRC</p> <p><input type="checkbox"/> SEAT MATERIAL _____ HARDNESS _____ HRC</p> <p><input type="checkbox"/> PACKING MATERIAL _____ LEAKOFF _____ kg/h</p> <p><input type="checkbox"/> SPRING SUPPORT OF VALVE REQUIRED</p> <p style="text-align:center;"><input type="radio"/> BY VENDOR <input type="radio"/> BY PURCHASER</p>

GOVERNOR-CONTROLLED VALVE(S):					
LOCATION	MAIN INLET	INDUCTION	<u>INDUCTION</u> EXTRACTION	<u>INDUCTION</u> EXTRACTION	NOTES
TRIP POSITION (OPEN/CLOSED)	Closed	Closed			
NUMBER OF VALVES	4	Grid valve			
CONNECTION SIZE	integral casing	integral casing			
RATING	N/A integral casing				
FACING (RF, RTJ, OTHER)					
ACTION (CAM, BAR, OTHER)	Bar	Other			
STEM MATERIAL	X19CrMoNiNbVN11.1				
STEM MATERIAL HARDNESS, HRC					
SEAT MATERIAL	AISI 410				
SEAT MATERIAL HARDNESS, HRC	84				
PACKING MATERIAL	A 355 Gr A				
PACKING LEAKOFF, kg/h					
TAG, No	N/A				

<p>TURNING GEAR</p> <p><input checked="" type="radio"/> TURNING GEAR REQUIRED</p> <p><input checked="" type="radio"/> FURNISHED BY <u>GE Thermodyn</u></p> <p><input checked="" type="radio"/> TYPE SSS clutch SPEED 150 r/min</p> <p><input checked="" type="radio"/> ENGAGEMENT : <input checked="" type="radio"/> AUTO <input type="radio"/> MANUAL</p> <p><input checked="" type="radio"/> MANUFACTURER Motox MODEL KAF 128</p> <p><input checked="" type="radio"/> MOUNTED BY <u>GE Thermodyn</u></p> <p><input type="radio"/> DRIVER: REFERENCE SPECIFICATION _____</p> <p>DRIVEN BY: <input checked="" type="radio"/> ELECTRIC MOTOR <input type="radio"/> STEAM TURBINE</p> <p style="text-align:center;"><input type="radio"/> HYD./PNEU. MOTOR <input type="radio"/> OTHER: _____</p> <p><input checked="" type="radio"/> OPERATOR STATION <input checked="" type="radio"/> LOCAL <input type="radio"/> REMOTE</p>	<p>MISCELLANEOUS</p> <p><input type="radio"/> START-UP ASSISTANCE _____ DAYS</p> <p><input type="radio"/> VENDOR'S REVIEW & COMMENTS ON PURCHASER'S PIPING AND FOUNDATION DRAWINGS</p> <p><input type="radio"/> VENDOR WITNESS INITIAL ALIGNMENT</p> <p><input checked="" type="checkbox"/> "Y" TYPE STRAINER</p> <p><input checked="" type="checkbox"/> WATER WASHING CONNECTIONS</p> <p><input type="radio"/> STATIC CONDUCTING BRUSHES</p> <p><input type="radio"/> SHUTDOWN ACTIVATES EXHAUST VACUUM BREAKER (12.3.1.3)</p> <p><input type="radio"/> _____</p> <p><input type="radio"/> _____</p>
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<p>INSULATION & JACKETING</p> <p><input checked="" type="radio"/> BLANKET <input type="radio"/> OTHER Mineral Fiber</p> <p><input checked="" type="radio"/> JACKETING</p> <p><input type="radio"/> CARBON STEEL <input checked="" type="radio"/> Aluminium</p> <p><input type="radio"/> EXTENT _____</p>	<p>SPECIAL TOOLS</p> <p><input type="radio"/> COUPLING RING AND PLUG GAUGE</p> <p><input type="radio"/> HYDRAULIC COUPLING MOUNTING/REMOVAL KIT</p> <p><input checked="" type="radio"/> OTHER Vendor list _____</p> <p><input checked="" type="checkbox"/> SPREADER BEAM(S)</p> <p style="text-align:center;"><input type="radio"/> ON LOAN</p> <p style="text-align:center;"><input checked="" type="radio"/> PURCHASE</p>
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		PROJECT TITLE _____	
		PROJECT SUB-TITLE _____ SULPHURIC ACID PLANT	
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1	GOVERNOR		
2	TYPE <input checked="" type="radio"/> DIGITAL PROCESSOR BASED	<input checked="" type="radio"/> MANUFACTURER - _____ MODEL Included in PLC Software	
3	<input type="radio"/> OTHER _____	<input checked="" type="radio"/> SUPPLIED BY GE Thermodyn	
4	<input checked="" type="radio"/> SIMPLEX <input type="radio"/> MULTI-CPU		
5	STEAM TURBINE TYPE		
6	<input type="radio"/> SINGLE VALVE SINGLE STAGE	<input type="radio"/> DOUBLE AUTOMATIC EXTRACTION	
7	<input type="radio"/> SINGLE VALVE MULTISTAGE	<input type="radio"/> SINGLE AUTOMATIC EXTRACTION/INDUCTION	
8	<input checked="" type="radio"/> MULTIVALVE MULTISTAGE	<input type="radio"/> DOUBLE AUTOMATIC EXTRACTION/INDUCTION	
9	<input type="radio"/> SINGLE AUTO EXTRACTION	<input type="radio"/> OTHER _____	
10	DRIVEN EQUIPMENT TYPE		
11	<input type="radio"/> CENTRIFUGAL COMPRESSOR	<input checked="" type="radio"/> SYNCHRONOUS GENERATOR	
12	<input type="radio"/> AXIAL COMPRESSOR	<input type="radio"/> INDUCTION GENERATOR	
13	<input type="radio"/> CENTRIFUGAL PUMP	<input type="radio"/> OTHER _____	
14	SERVICE REQUIREMENTS		
15	<u>MECHANICAL DRIVE</u>	<u>GENERATOR DRIVE</u>	
16	<input type="radio"/> SPEED CONTROL BY:	<input type="radio"/> DROOP CONTROL	
17	PROCESS VARIABLE <input type="radio"/> PRESSURE <input type="radio"/> FLOW	<input type="radio"/> FREQUENCY CONTROL	
18	EXTRACTION <input type="radio"/> PRESSURE <input type="radio"/> FLOW	<input type="radio"/> LOAD CONTROL	
19	INDUCTION <input type="radio"/> PRESSURE <input type="radio"/> FLOW	<input type="radio"/> KW CONTROL	
20	TURBINE INLET <input type="radio"/> PRESSURE <input type="radio"/> FLOW	<input type="radio"/> KW IMPORT/EXPORT CONTROL	
21	TURBINE EXHAUST <input type="radio"/> PRESSURE <input type="radio"/> FLOW	<input type="radio"/> LOAD SHEDDING	
22	OTHER _____	<input type="radio"/> AUTOMATIC SYNCHRONIZATION	
23	_____	<input type="radio"/> AUTOMATIC VOLTAGE REGULATION	
24	_____	<input type="radio"/> TURBINE INLET PRESSURE LIMITING	
25		<input type="radio"/> INLET PRESSURE LIMITER	
26	INPUT/OUTPUT REQUIREMENTS		
27	<u>DISCRETE INPUTS</u>	<u>DISCRETE OUTPUTS</u>	
28	<input checked="" type="radio"/> START OR RESET	<input checked="" type="radio"/> COMMON SHUTDOWN	
29	<input checked="" type="radio"/> NORMAL STOP	<input type="radio"/> COMMON ALARM	
30	<input checked="" type="radio"/> EMERGENCY TRIP	<input checked="" type="radio"/> OVERSPEED TRIP _____ 6270 r/min	
31	<input checked="" type="radio"/> RAISE SPEED	<input type="radio"/> REMOTE SPEED SETPOINT ENABLED	
32	<input checked="" type="radio"/> LOWER SPEED	<input type="radio"/> PRESSURE CONTROL ENABLED	
33	<input type="radio"/> ENABLE/DISABLE REMOTE SPEED SETPOINT	<input type="radio"/> FLOW CONTROL ENABLED	
34	<input type="radio"/> RAMP TO MINIMUM CONTINUOUS	<input type="radio"/> EXTRACTION CONTROL ENABLED	
35	<input type="radio"/> OVERSPEED TEST ENABLE	<input type="radio"/> INDUCTION CONTROL ENABLED	
36	<input type="radio"/> ENABLE PRESSURE CONTROL	<input type="radio"/> SPEED PICKUP ALARM	
37	<input type="radio"/> ENABLE EXTRACTION CONTROL	<input type="radio"/> OTHER _____	
38	<input type="radio"/> REMOTE ALARM CLEAR/ACKNOWLEDGE		
39	<input type="radio"/> ENABLE AUTO SYNCHRONIZE		
40	<input type="radio"/> CASCADE RAISE/LOWER		
41	<input type="radio"/> OTHER _____		
42	<u>ANALOG INPUTS (4 mA to 20 mA)</u>	<u>ANALOG OUTPUTS (4 mA to 20 mA)</u>	
43	<input type="radio"/> REMOTE SET POINT	<input type="radio"/> SPEED	
44	<input type="radio"/> PROCESS PRESSURE	<input type="radio"/> SPEED SETPOINT	
45	<input type="radio"/> EXTRACTION <input type="radio"/> PRESSURE <input type="radio"/> FLOW	<input type="radio"/> REMOTE SPEED SETPOINT	
46	<input type="radio"/> KW IND. LOAD <input type="radio"/> PRESSURE <input type="radio"/> FLOW	<input type="radio"/> EXTRACTION PRESSURE	
47	<input type="radio"/> KW IMPORT/EXPORT	<input type="radio"/> EXTRACTION PRESSURE SETPOINT	
48	<input type="radio"/> OTHER _____	<input type="radio"/> ACTUATOR POSITION	
49	_____	<input type="radio"/> PROCESS PRESSURE	
50	_____	<input type="radio"/> kW	
51	_____	<input type="radio"/> kW IMPORT/EXPORT	

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STEAM TURBINE DATA SHEET SI UNITS	Project N° Unit Document Code Serial N° Rev Page 650 001 0 9
1 GOVERNOR INSTALLATION REQUIREMENTS	
2 LOCATION <input type="radio"/> LOCAL (AT TURBINE) <input checked="" type="radio"/> REMOTE (CONTROL ROOM) <input type="radio"/> OTHER Field instrument room 5 AREA CLASSIFICATION: Safe CLASS ___ GROUP ___ DIVISION ___ ZONE ___ GROUP ___ TEMP. RATING: ___ 8 ENCLOSURE <input checked="" type="radio"/> IP65 <input type="radio"/> NEMA 4 <input type="radio"/> NEMA 4X <input type="radio"/> OTHER _____	MOUNTING <input type="radio"/> FLUSH MOUNT IN PANEL <input checked="" type="radio"/> SURFACE MOUNT <input type="radio"/> VERTICAL RACK POWER SOURCE SINGLE DUAL 120 V (A.C.) <input type="radio"/> <input type="radio"/> 220 V (A.C.) <input type="radio"/> <input type="radio"/> 125 V (D.C.) <input type="radio"/> <input type="radio"/> 24 V (D.C.) <input type="radio"/> <input type="radio"/> _____ <input type="radio"/> <input type="radio"/> _____ <input type="radio"/> <input type="radio"/>
12 LOCAL GOVERNOR CONTROL PANEL <input type="radio"/> REQUIRED <input checked="" type="radio"/> NOT REQUIRED	
13 LOCATION <input type="radio"/> LOCAL (AT TURBINE) <input type="radio"/> REMOTE CONTROL ROOM <input type="radio"/> OTHER _____ 17 OUTPUTS FROM PANEL TO GOVERNOR <input type="radio"/> START <input type="radio"/> TRIP <input type="radio"/> RAISE <input type="radio"/> LOWER <input type="radio"/> OVERSPEED TEST <input type="radio"/> RAMP TO MINIMUM CONTINUOUS <input type="radio"/> REMOTE SETPOINT ENABLE/DISABLE <input type="radio"/> RESET <input type="radio"/> OTHER _____	ENCLOSURE <input type="radio"/> IP65 <input type="radio"/> NEMA 4 <input type="radio"/> NEMA 4X <input type="radio"/> OTHER _____ <input checked="" type="radio"/> AREA CLASSIFICATION: Safe CLASS ___ GROUP ___ DIVISION ___ ZONE ___ GROUP ___ TEMP. RATING: ___ INPUTS TO PANEL FROM GOVERNOR <input type="radio"/> COMMON ALARM TRIP <input type="radio"/> TRIP LAMP <input type="radio"/> REMOTE SETPOINT ENABLED LAMP <input type="radio"/> SPEED SETPOINT METER <input checked="" type="radio"/> OTHER 9806J _____ _____
27 MISCELLANEOUS GOVERNOR DETAILS	
28 GOVERNOR ACTION ON LOSS OF REMOTE SIGNAL: <input checked="" type="radio"/> LOCKS ON LAST VALUE <input type="radio"/> GOES TO MINIMUM CONTINUOUS <input type="radio"/> GOES TO MAXIMUM CONTINUOUS	
32 EXTERNAL INTERFACE DEVICE TYPE: <input type="radio"/> PRINTER FORMAT: <input checked="" type="radio"/> GRAPHIC DISPLAY <input type="radio"/> CRT <input type="radio"/> MODEM <input type="radio"/> TABULAR DATA <input type="radio"/> MODEM <input type="radio"/> TRENDING (REAL TIME) <input type="radio"/> HISTORICAL ARCHIVING <input type="radio"/> DISTRIBUTIVE CONTROL SYSTEM MANUFACTURER _____ <input type="radio"/> MODEL _____	
37 DATA TRANSMISSION <input type="radio"/> DATA LINK <input type="radio"/> PROTOCOL _____ <input type="radio"/> DISCRETE I/O <input type="radio"/> NETWORK TYPE _____	
41 GOVERNOR SPEED PICKUP SENSORS : MANUFACTURER <u>BENTLY NEVADA</u> MODEL <u>3300</u> INSTALLATION: <input checked="" type="radio"/> DUAL <input type="radio"/> TRIPLE <input type="radio"/> INSTALLED SPARE <input checked="" type="radio"/> NUMBER OF TEETH IN SPEED SENSING SURFACE <u>Multi</u>	
45 ACTUATOR(S): <input checked="" type="radio"/> SUPPLIED BY <u>GE Thermodyn</u> <input type="radio"/> MANUFACTURER <u>MOOG</u> <input type="radio"/> MODEL _____ 45 ACTUATOR TYPE <input checked="" type="radio"/> HYDRAULIC <input type="radio"/> PNEUMATIC <input checked="" type="radio"/> SINGLE COIL <input type="radio"/> MULTI COIL <input type="radio"/> OTHER _____	
47 TURBINE MOUNTED ACCESSORIES	
48 TACHOMETER <input type="radio"/> MANUFACTURER _____ <input type="radio"/> MODEL _____ <input type="radio"/> NUMBER REQUIRED. _____ <input type="radio"/> LOCATION(S) _____	
51	

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STEAM TURBINE		Project N°	Unit	Document Code	Serial N°	Rev	Page																																																								
DATA SHEET		650			001	0	10																																																								
SI UNITS																																																															
1 OVERSPEED SHUTDOWN SYSTEM																																																															
2 ● FURNISHED BY <u>GE Thermodyn</u> 3 ○ MANUFACTURER <u>BENLTY NEVADA</u> ○ MODEL <u>3500</u> 4 ■ ELECTRONIC, SET POINT <u>6270 r/min</u> 5 OVERSPEED SHUTDOWN REQUIREMENTS 6 ● 2 OUT OF 3 VOTING LOGIC 7 ○ OTHER _____ 8 _____ 9 _____		● NUMBER OF TEETH IN SPEED SENSING SURFACE <u>Multi</u> ○ SOLENOIDS SHALL: ● DE-ENERGIZE TO TRIP ○ ENERGIZE TO TRIP ○ CONTACTS SHALL BE: ○ NORMALLY OPEN ○ NORMALLY CLOSED ○ VOLTAGE LEVEL: _____ _____ _____																																																													
10 GLAND SEALING AND VACUUM SYSTEM																																																															
11 SYSTEM PER: ○ ANNEX G.1 ● ANNEX G.2 12 ○ OTHER _____		● VACUUM SYSTEM FURNISHED BY <u>GE Thermodyn</u> ○ SHIP LOOSE ● SKID MOUNTED ○ OTHER _____																																																													
13 ○ AVAIL. HEADER PRESSURE _____ Barg TEMPERATURE _____ °C 14 ● AVAILABLE SEAL STEAM SUPPLY PRESSURE <u>9</u> Barg 15 ● AVAILABLE SEAL STEAM SUPPLY TEMPERATURE <u>220</u> °C 16 □ SEAL. STM. PRESS. <u>0,1</u> Barg ■ FLOW <u>141</u> kg/h 17 □ SEALING STEAM RELIEF VALVE SET PRESSURE _____ Barg		● GLAND CONDENSOR, SEE SPECIFICATION <u>TEMA C</u> ○ STEAM EJECTOR □ STEAM PRESS. _____ Barg □ STEAM FLOW _____ kg/h ○ VACUUM PUMP , SEE SPECIFICATION _____ ● CONDENSATE RECEIVER _____ ○ LOOP SEAL HEIGHT _____ m																																																													
18 ● FURNISHED BY <u>Samson</u> 19 ■ FLOW ADJUSTING VALVES, TYPE <u>3241-7</u> 20 ● FURNISHED BY <u>GE Thermodyn</u>																																																															
INSPECTION AND TESTING																																																															
22 GENERAL				MECHANICAL RUNNING TEST																																																											
23 ● SHOP INSPECTION 24 EXTENT _____ 25 ○ REFERENCE INSPECTION CHECKLIST 26 _____				<table style="width:100%; border-collapse: collapse;"> <thead> <tr> <th style="width:60%;"></th> <th style="width:10%;">OBSVD</th> <th style="width:10%;">WIT</th> </tr> </thead> <tbody> <tr><td>○ CONTRACT ROTOR</td><td style="text-align:center;">○</td><td style="text-align:center;">○</td></tr> <tr><td>○ SPARE ROTOR</td><td style="text-align:center;">○</td><td style="text-align:center;">○</td></tr> <tr><td>○ TEST W/JOB COUPLING</td><td style="text-align:center;">○</td><td style="text-align:center;">○</td></tr> <tr><td>○ TEST TAPE RECORD REQUIRED</td><td style="text-align:center;">○</td><td style="text-align:center;">○</td></tr> <tr><td>○ TEST TAPE GIVEN TO PURCH.</td><td style="text-align:center;">○</td><td style="text-align:center;">○</td></tr> <tr><td>● TEST W/JOB LUBE OIL CONSOLE</td><td style="text-align:center;">●</td><td style="text-align:center;">○</td></tr> <tr><td>_____</td><td style="text-align:center;">○</td><td style="text-align:center;">○</td></tr> </tbody> </table>					OBSVD	WIT	○ CONTRACT ROTOR	○	○	○ SPARE ROTOR	○	○	○ TEST W/JOB COUPLING	○	○	○ TEST TAPE RECORD REQUIRED	○	○	○ TEST TAPE GIVEN TO PURCH.	○	○	● TEST W/JOB LUBE OIL CONSOLE	●	○	_____	○	○																																
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27 INSPECTION AND MATERIAL TESTING																																																															
29 SPECIAL MATERIAL INSPECTION & TESTING REQUIREMENTS																																																															
<table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th style="width:15%;">COMPONENT</th> <th style="width:10%;">MAG PART</th> <th style="width:10%;">DYE PEN</th> <th style="width:10%;">R.T.</th> <th style="width:10%;">U.T.</th> <th style="width:10%;">OBSVD</th> <th style="width:10%;">WIT</th> </tr> </thead> <tbody> <tr><td>31 TRIP & T & T</td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>32 VALVE</td><td style="text-align:center;">●</td><td style="text-align:center;">○</td><td style="text-align:center;">○</td><td style="text-align:center;">○</td><td style="text-align:center;">●</td><td style="text-align:center;">○</td></tr> <tr><td>33 STM CHEST</td><td style="text-align:center;">●</td><td style="text-align:center;">○</td><td style="text-align:center;">○</td><td style="text-align:center;">●</td><td style="text-align:center;">●</td><td style="text-align:center;">○</td></tr> <tr><td>34 CASING</td><td style="text-align:center;">●</td><td style="text-align:center;">○</td><td style="text-align:center;">○</td><td style="text-align:center;">●</td><td style="text-align:center;">●</td><td style="text-align:center;">○</td></tr> <tr><td>35 PIPING</td><td style="text-align:center;">○</td><td style="text-align:center;">○</td><td style="text-align:center;">●</td><td style="text-align:center;">○</td><td style="text-align:center;">●</td><td style="text-align:center;">○</td></tr> <tr><td>36 ROTOR</td><td style="text-align:center;">○</td><td style="text-align:center;">○</td><td style="text-align:center;">○</td><td style="text-align:center;">●</td><td style="text-align:center;">●</td><td style="text-align:center;">○</td></tr> <tr><td>37 Casing weld</td><td></td><td style="text-align:center;">●</td><td style="text-align:center;">●</td><td></td><td style="text-align:center;">●</td><td style="text-align:center;">○</td></tr> </tbody> </table>				COMPONENT	MAG PART	DYE PEN	R.T.	U.T.	OBSVD	WIT	31 TRIP & T & T							32 VALVE	●	○	○	○	●	○	33 STM CHEST	●	○	○	●	●	○	34 CASING	●	○	○	●	●	○	35 PIPING	○	○	●	○	●	○	36 ROTOR	○	○	○	●	●	○	37 Casing weld		●	●		●	○	38 ○ HEAT STABILITY 39 ● CLEANLINESS 40 ○ HARDNESS 41 ● HYDRO TESTS 42 ○ BLADE SHAKER (STATIC) 43 ROTOR BALANCE ● STANDARD ○ HIGH SPEED ○ LOW SPEED PRIOR TO HIGH SPEED ○ LOW SPEED RESIDUAL UNBALANCE CHECK 47 ● FINAL SURFACE INSPECTION 48 ○ CRATING INSPECTION 49 ○ SPARE ROTOR FIT 50 ○ CASING JOINT LEAK TEST 51 ● FINAL CHECK (PUNCH LIST) _____			
COMPONENT	MAG PART	DYE PEN	R.T.	U.T.	OBSVD	WIT																																																									
31 TRIP & T & T																																																															
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				OPTIONAL TESTS <table style="width:100%; border-collapse: collapse;"> <thead> <tr> <th style="width:60%;"></th> <th style="width:10%;">OBSVD</th> <th style="width:10%;">WIT</th> </tr> </thead> <tbody> <tr><td>○ PERFORMANCE</td><td style="text-align:center;">○</td><td style="text-align:center;">○</td></tr> <tr><td>○ COMPLETE UNIT</td><td style="text-align:center;">○</td><td style="text-align:center;">○</td></tr> </tbody> </table> AUXILIARY EQUIPMENT ● TRIP/TRIP & THROTTLE VALVE ○ ● ○ GLAND SEAL SYSTEM ○ ○ ○ GLAND VACUUM SYSTEM ○ ○ ○ RELIEF VALVES ○ ○ ○ _____ ○ ○ ○ CASING INTERNAL INSP ○ ○ ○ COUPLING TO SHAFT FIT ○ ○ ○ TURNING GEAR ○ ○ ○ OVERSPEED SHUTDOWN SYS. ○ ○ ○ GOVERNOR RESPONSE ○ ○ ○ SOUND ○ ○ ○ SPARE PARTS TESTS ○ ○ ○ _____ ○ ○ ○ _____ ○ ○					OBSVD	WIT	○ PERFORMANCE	○	○	○ COMPLETE UNIT	○	○																																															
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1 2 PAINTING 3 <input checked="" type="radio"/> MANUFACTURER'S STANDARD 4 <input type="radio"/> OTHER _____ 5 <input type="radio"/> 6 UNIT NAMEPLATE UNITS <input type="radio"/> U.S. CUSTOMARY <input checked="" type="radio"/> SI 7 SHIPMENT 8 <input type="radio"/> DOMESTIC <input checked="" type="radio"/> EXPORT 9 <input type="radio"/> EXPORT BOXING REQD. <input checked="" type="radio"/> OUTDOOR STORAGE OVER 6 MONTHS 10 <input type="radio"/> WATERPROOF BOXING REQUIRED 11 <input type="radio"/> SPARE ROTOR ASSEMBLY PACKAGED FOR: 12 <input type="radio"/> HORIZONTAL STORAGE <input type="radio"/> VERTICAL STORAGE (WEIGHTS: <input checked="" type="checkbox"/> TURBINE _____ 22500 kg <input checked="" type="checkbox"/> ROTOR _____ 3700 kg <input checked="" type="checkbox"/> TURBINE UPPER HALF CASING _____ 7985 kg <input checked="" type="checkbox"/> MAXIMUM FOR MAINTENANCE (IDENTIFY) _____ 16000 (*) kg <input checked="" type="checkbox"/> TRIP/TRIP & THROTTLE VALVE _____ 770 kg <input type="checkbox"/> MISCELLANEOUS _____ kg <input type="checkbox"/> TOTAL SHIPPING MASS _____ kg (*) Generator Rotor												
13 SPACE REQUIREMENTS: 14 <input checked="" type="checkbox"/> COMPLETE UNIT: L 6850 mm W 4350 mm H 4000 mm 15 <input type="checkbox"/> CONTROL PANEL: L _____ mm W _____ mm H _____ mm 16 <input type="checkbox"/> OTHER: L _____ mm W _____ mm H _____ mm 17 <input type="checkbox"/> OTHER: L _____ mm W _____ mm H _____ mm	VENDOR DRAWING & DATA REQUIREMENTS <input type="radio"/> ANNEX J <input checked="" type="radio"/> OTHER _____ _____ _____												
18 REMARKS AND ADDITIONAL REQUIREMENTS: 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46													