WorleyParsons
resources & energy

TAMOIL
TAMOIL RAFFINAZIONE S.p.A
Raffinaria di Cremona

Tamoil Cremona Refinery
Cremona Upgrading Program (CUP)
Hydrocracker Project
MECHANICAL EQUIPMENT LIST
HCU,VDU,SRU,AMINE TREATMENT, HYDROGEN, VBU, SWS, UTILITIES & OFFSITES

							Document No:		**Client Document No:**	
							180480-HCU-000-31-353-0001		**07003-90-PE-0001**	
01	04-Oct-07	Issued for Internal Review	S.Sarkar				Project No: 180480	Rev: 01	Project No:	Rev: 01
Rev	Date	Issue Description	Orig	Check	Appr	Client				

Equipment List Process Basis

Unit Numbering :

VDU : 010 / HCU: 011 / HYDROGEN : 012 / SWS, SRU: 013 / Amine Treatment : 014

Visbreaker (VBU) ,Thermal Gas Oil (TGU): 600

Utilities, Tankages, Waste Water treatment: part of HCU (011)

Notes:

A design is to be kept to 1 line with repeats shown in sequential number eg 'A/B' or 'A-F'.

Revisions - Lines to be background Yellow for each revision.

- Deletions to be Shown in Red at bottom of each unit list as part of Notes.

Vessel Dimensions i.e. T/T to be indicated Top/Middle/Bottom

Type Means: Exchangers: TEMA Type

Heaters: Fired Heaters Cabin / Box / Cylindrical or Other Heaters Steam / Water / Electric

Pumps: Centrifugal / Reciprocating etc

Compressors: Centrifugal / Reciprocating etc

Tanks: Fixed Cone / Floating Roof

Surface Area m² : S&T Exchangers Surface Area & Air Coolers Extended Surface Area

Unless specified in the remarks column the following assumptions will be made.

S&T - Tube lengths will be assumed 6m in Length.

Horizontal Vessels will be assumed to have 2 saddles.

Vertical veseels will be assumed to have 2.5m skirt.

Boilers to be specified in remarks column: Tonnes of Steam / Hour, Superheat Temp (°C)

Sphere Launchers / Recievers - mention Line size in Remarks Column.

Reason for Revision:

Required for October Estimate

Unit No.	Unit Description	Designs	Pieces
	Total		

EQUIPMENT TAG NUMBER				DESCRIPTION	P&ID No:	Datasheet No:	TYPE	DUTY (MW)	SURFACE AREA (m^2)	CAPACITY / RATING (EACH)	Diff. HEAD (m)	Diff. Pressure (Bar)	Maximum Specific Gravity	MOTORs (kW)			DESIGN CONDITIONS			DIMENSIONS / UNIT *(Estimated in italics)*			ORIENTATION. H or V	MATERIAL of CONST.	CA - mm	MISCELLANEOUS : INTERNALS / BAYS / No. OF FANS / LENGTH OF TUBES	PAINTING & INSULATION		CALCULATED WEIGHT per UNIT (Estimated in italics)		MR / Budget Price No.	REMARKS
	Unit	EQ. TYPE	Sequential Number											Steam / Gas / Electric / Diesel	Absorbed KW	Motor KW	PRESSURE - Barg	TEMP. MAX (°C)	TEMP. MIN (°C)	Length (T-T) mm	Width / ID-mm	Height (T-T) mm					SPEC	THK. mm	DRY - kg	TEST -kg		
				Columns																													
	13	C	101	Process Water Stripper	-	-	Trayed Column	-	-	-	-	-	-	-	-	-	4.0/FV	170	-15		1,600	20,000	V	Carbon steel, 6 mm CA. Top (from 0.6 m below feed) CS + 3.0 mm + Clad 316L		24 Sieve trays MOC: 316L						NACE requirement MR0103
	14	C	201	LP Absorber			Trayed Column	-	-	-	-	-	-	-	-	-	6.2	75.0	-15		813 X 1600	20,800	V	Carbon steel, 3 mm CA. Bottom (below tray # 21) Clad 316L		21 Valve trays MOC : 316L						
	14	C	202	MDEA Regenerator			Trayed Column	-	-	-	-	-	-	-	-	-	4.0 / FV	160.0	-15		1,676	23,000	V	Carbon steel, 3 mm CA + Clad 316L		20 Valve trays MOC : 316L						NACE requirement MR0103
	11	C	101	HP H2S Absober	-	-	Packed Column	-	-	-	-	-	-	-	-	-	152	260	-15		1200	10200	V	Shell & heads = CS + 3mm 308L wol, trays & internals = 304 *304L if welded)		10 M						
	11	C	201	Product Stripper	-	-	Packed Column	-	-	-	-	-	-	-	-	-	8.8	260	-15		1500 top (tray 1-3), 2100	19100	V	Top head & shell to 3 m, below reflux = CS (per GN-9) + 4.5 mm, flash zone = CS + 2.5 mm		19 M						
	11	C	202	Product Fractionator	-	-	Trayed Column	-	-	-	-	-	-	-	-	-	3.5	380	-15		3600 top (tray 1-32), 2700 bottom	40800	V	Bottom head and shell up = CS + 2.5mm 410S clad, top head & shell to 3m below, reflux = CS		40						
	11	C	203	Kerosene Stripper	-	-	Trayed Column	-	-	-	-	-	-	-	-	-	3.7	260	-15		1200	12700	V	Shell & heads = CS + 3mm, internals = CS + 3mm, Trays = 12 Cr		10						
	11	C	204	Diesel Stripper	-	-	Trayed Column	-	-	-	-	-	-	-	-	-	3.8	305	-15		1700	11900	V	Shell & heads = CS + 4.5mm, internals = CS + 4.5mm, Trays = 12 Cr		10						
	11	C	301	Naphtha Stabilizer	-	-	Trayed Column	-	-	-	-	-	-	-	-	-	11.7	260	-15		900 top (tray 1-17), 1500 bottom (tray	24900	V	Shell = CS + 3mm, channel = CS + 4.5mm, tubesheet = CS + 4.5mm, tubes = CS (14 gauge)		29						
	11	C	302	Naphtha Splitter	-	-	Trayed Column	-	-	-	-	-	-	-	-	-	3.5	260	-15		1500	22500	V	Top head & shell to 3 m, below reflux = CS (PWHT) + 4.5 mm, remainder = CS + 3 mm, trays =		27						
	600	C	601	Main Frac			Trayed Column	-	-	-	-	-	-	-	-	-	As Existing	As Existing			3,200		H	410SS		33 trays							Add blamking plates on all trays, modify bottom section internals, blank off kero offtake.
	~~600~~	~~C~~	~~602A~~	~~Kero Stripper~~			Trayed Column	-	-	-	-	-	-	-	-	-	As Existing	As Existing			1,099	5,860	H			5 trays							Decommission
	600	C	602B	Diesel Stripper			Trayed Column	-	-	-	-	-	-	-	-	-	As Existing	As Existing			1,099	8,140	H										Existing Unit, no change anticipated
	600	C	603	Stabiliser			Trayed Column	-	-	-	-	-	-	-	-	-	As Existing	As Existing			1,000 1,400	9,840 14,410	H	410SS		trays 1 to 15 trays 16 to 32							Modify all trays
	600	C	604	Splitter			Trayed Column	-	-	-	-	-	-	-	-	-	As Existing	As Existing			1,293	16,100	H	410SS		20 trays							Modify all trays
	600	C	691	Vacuum Flash Column			Packed Column	-	-	-	-	-	-	-	-	-	O bar abs. (full vacuum)	400	-15	8,000	1,500		H	410SS		3 X PACKED BEDS EACH 1m HIGH							New Unit
	10	C	101	Vacuum Distillation Column - Top Section				-	-	-	-	-	-	-	-	-	3.5 / FV	420	-15		5,000	7,200		CS(PWHT)	4.5							Total Tan-Tan Height: 41775 mm Height for each section are estimated values
				Bed1	-	-	Koch-Glitsch Flexipac 2X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2,100		12 Cr		Trough type distributor							
	10	C	101	Vacuum Distillation Column - Middle Section				-	-	-	-	-	-	-	-	-	3.5 / FV	420	-15		8,000	22,000		CS+410S CLAD	2.5							
				Bed 2	-	-	Koch-Glitsch Flexipac 3X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2,600		12 Cr		Spray nozzle distributor							
				Wash Bed 1 - Top	-	-	Koch-Glitsch Flexipac 3.5 Y	-	-	-	-	-	-	-	-	-	-	-	-	-	-	800		12 Cr		Trough type distributor							
				Wash Bed 1 - Bottom			Koch-Glitsch Flexgrid Style #3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	800		12 Cr									
				Wash Bed 2 - Top	-	-	Koch-Glitsch Flexipac 3.5 Y	-	-	-	-	-	-	-	-	-	-	-	-	-	-	800		12 Cr		Spray nozzle distributor							
				Wash Bed 2- Bottom	-	-	Koch-Glitsch Flexgrid Style #3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	800		12 Cr		Spray nozzle distributor							
	10	C	101	Vacuum Distillation Column - Bottom Section				-	-	-	-	-	-	-	-	-	3.5 / FV	420	-15	-	3,000	3,600		CS+410S CLAD	2.5							
				Stripping Section	-	-	Sieve / Fixed valve tray	-	-	-	-	-	-	-	-	-	-	-	-	-	3,000			12 Cr								5 Trays
	10	C	101	Vacuum Distillation Column - Boot	-	-		-	-	-	-	-	-	-	-	-	3.5 / FV	420	-15	-	2,400	1,900		CS+410S CLAD	2.5							
																				-												
	13	C	301	Degassing Contactor			Packed Column	-	-	-	-	-	-	-	-	-	13.0	188	-15	-	508	9,750	V	A106	3.0	316L Structured Packing							Steam Jacket
Notes:																																
1																																
2																																
3																																
4																																
5																																
6																																

EQUIPMENT TAG NUMBER				DESCRIPTION	P&ID No:	Datasheet No:	TYPE	DUTY (MW)	SURFACE AREA (m^2)	CAPACITY / RATING (EACH)	Diff. HEAD (m)	Diff. Pressure (Bar)	Maximum Specific Gr	MOTORs (kW)			DESIGN CONDITIONS			DIMENSIONS / UNIT *(Estimated in italics)*			ORIENTATION, H or V	MATERIAL of CONST.	CA - mm	MISCELLANEOUS : INTERNALS / BAYS / No. OF FANS / LENGTH OF TUBES	PAINTING & INSULATION		CALCULATED WEIGHT per UNIT (Estimated in italics)		MR / Budget Price No.	REMARKS
	Unit	EQ. TYPE	Sequential Number											Steam / Gas / Electric / Diesel	Absorbed KW	Motor KW	PRESSURE - Barg	TEMP. MAX (°C)	TEMP. MIN (°C)	Length (T-T) mm	Width / ID-mm	Height (T-T) mm					SPEC	THK. mm	DRY - kg	TEST -kg		
				Vessels																													
	13	V	101	Process Water Feed Drum	-	-	-	-	-	-	-	-	-	-	-	-	4.0	75	-15	6,000	1,500	-	H	CS+316L Clad	3	Baffles, Mesh Pad MOC of Internals : 316L						NACE
	13	V	102	Stripper Reflux Drum	-	-	-	-	-	-	-	-	-	-	-	-	4.0/FV	130	-15	-	1,100	3,035	V	CS+316L Clad	3	Mesh Pad MOC of Internals : 316L						NACE
	13	V	103	Reboiler Condensate Pot	-	-	-	-	-	-	-	-	-	-	-	-	5.0/FV	180	-15	-	600	1,600	V	CS	3							
	14	V	201	Regenerator Reflux Drum	-	-	-	-	-	-	-	-	-	-	-	-	4.5 / FV	75	-15	-	800	3,200	V	CS+316L Clad (Nace requiremetn MR0103)	3.0	316L						
	14	V	202	Condensate Drum	-	-	-	-	-	-	-	-	-	-	-	-	5.0 / FV	180	-15	-	700	2,400	V	CS	3.0	304L						
	14	V	203	Amine Sump Drum	-	-	-	-	-	-	-	-	-	-	-	-	3.5	155	-15	4,600	1,300	-	H	CS	3.0	304L						
	11	V	101	Filtered Feed Surge Drum	-	-	-	-	-	-	-	-	-	-	-	-	5.3	260	-15	-	2500	7900	V	Shell & heads = CS + 3mm								
	11	V	102	Second Stage Feed Surge Drum	-	-	-	-	-	-	-	-	-	-	-	-	5.3	280	-15	-	2400	7200	V	Shell & heads = CS + 4.5mm								
	11	V	103	Hot High Presure Separator	-	-	-	-	-	-	-	-	-	-	-	-	155	288	-15	-	2500	6800	V	Shell & heads = 2 1/4 Cr-1 Mo + 6mm, permanent internals = 2 1/4 Cr-1 Mo + 6mm, removable internals = 2 1/4 Cr-1 Mo + 3mm, wear plate = 2 1/4 Cr-1 Mo + 6mm								
	11	V	104	Cold High Presure Separator	-	-	-	-	-	-	-	-	-	-	-	-	152	260	-15	-	1900	4400	V	Shell & heads = CS + 3mm 308L wol, internals = 304L + 1mm, demister & coalescer = 316 SS								
	11	V	105	Hot Low Presure Separator	-	-	-	-	-	-	-	-	-	-	-	-	31.8	288	-15	-	2800	8400	V	Shell & heads = CS + 6mm, permanent internals = CS + 6mm, removable internals = CS + 3mm								
	11	V	106	Cold Low Presure Separator	-	-	-	-	-	-	-	-	-	-	-	-	30.8	260	-15	-	1400	5200	V	Shell & heads = CS + 3mm 304L clad, internals = 304L + 1 mm, demister & coalescer = 316 SS								
	11	V	107	Sour Water Degasser	-	-	-	-	-	-	-	-	-	-	-	-	9.9	260	-15	-	900	5300	V	Shell & heads = CS + 2.5mm 304L clad, internals = 304L + 1 mm, trays = 304L								
	11	V	108	Injection Water Drum	-	-	-	-	-	-	-	-	-	-	-	-	5.3	260	-15	-	1000	2900	V	Shell & heads = CS (PWHT) + 3mm + epoxy phenolic coating per chevron spec								
	11	V	109	High Pressure Centrifugal Separator	-	-	-	-	-	-	-	-	-	-	-	-	152	260	-15	-	1500	3000	V	Shell & heads = CS + 3mm 308L wol, internals = 304L + 1mm								Preliminary - To be confirmed by compressor vendor
	11	V	110	Recycle Gas Compressor KO Drum	-	-	-	-	-	-	-	-	-	-	-	-	152	260	-15	-	1700	2600	V	Shell & heads = CS (per GN-9) + 3mm, demister = 316 SS								
	11	V	111	Lean Amine Surge Drum	-	-	-	-	-	-	-	-	-	-	-	-	5.3	260	-15	-	1300	4000	V	Shell & heads = CS (PWHT) + 3mm								
	11	V	112	Rich Amine Flash Drum	-	-	-	-	-	-	-	-	-	-	-	-	12	260	-15	4700	1500	-	H	Shell & heads = CS (per GN-9) + 6mm								
	11	V	113	Backwash Oil Surge Drum	-	-	-	-	-	-	-	-	-	-	-	-	3.5	260	-15	-	2600	7900	V	Shell & heads = CS + 3mm								
	11	V	201	Product Stripper Reflux Drum	-	-	-	-	-	-	-	-	-	-	-	-	8.8	260	-15	4900	1600	-	H	Shell = CS (per GN-9) + 4.5mm, channel = CS + 3mm, tubesheet = CS + 4.5mm, tubes = CS (12 gauge)		boot: T-T=1920mm , ID=720mm						
	11	V	202	Fractionator Reflux Drum	-	-	-	-	-	-	-	-	-	-	-	-	3.5	260	-15	6100	1900	-	H	Shell & heads = CS (PWHT) + 3mm, boot = CS (PWHT) + 4.5mm		boot: T-T=1500mm , ID=1100mm						
	11	V	301	Naphtha Stabilizer Reflux Drum	-	-	-	-	-	-	-	-	-	-	-	-	11.7	260	-15	3200	1200	-	H	Shell & heads = CS (PWHT) + 4.5mm, boot = CS + 2.5mm 304L clad		boot: T-T=850mm , ID=610mm						
	11	V	302	Naphtha Splitter Reflux Drum	-	-	-	-	-	-	-	-	-	-	-	-	3.5	260	-15	4100	1300	-	H	Shell & heads = CS + 4.5mm								
	11	V	401	Make-Up Hydrogen 1st Stage Suction Drum	-	-	-	-	-	-	-	-	-	-	-	-	31.1	260	-15	-	800	2600	V	Shell & heads = CS + 3mm, permanent internals = CS + 4mm, demister = 316 SS, wear plate (when used) = 304L								
	11	V	402 A	Make-Up Hydrogen 2nd Stage Suction Drum - Train A	-	-	-	-	-	-	-	-	-	-	-	-	56.1	260	-15	-	700	2600	V	Shell & heads = CS + 3mm, permanent internals = CS + 4mm, demister = 316 SS, wear plate (when used) = 304L								
	11	V	402 B	Make-Up Hydrogen 2nd Stage Suction Drum - Train B	-	-	-	-	-	-	-	-	-	-	-	-	56.1	260	-15	-	700	2600	V	Shell & heads = CS + 3mm, permanent internals = CS + 4mm, demister = 316 SS, wear plate (when used) = 304L								
	11	V	403 A	Make-Up Hydrogen 3rd Stage Suction Drum - Train A	-	-	-	-	-	-	-	-	-	-	-	-	102.8	260	-15	-	700	2600	V	Shell & heads = CS + 3mm, permanent internals = CS + 4mm, demister = 316 SS, wear plate (when used) = 304L								
	11	V	403 B	Make-Up Hydrogen 3rd Stage Suction Drum - Train B	-	-	-	-	-	-	-	-	-	-	-	-	102.8	260	-15	-	700	2600		Shell & heads = CS + 3mm, permanent internals = CS + 4mm, demister = 316 SS, wear plate (when used) = 304L								
	11	V	507	Oily Water Catch Drum	-	-	-	-	-	-	-	-	-	-	-	-	3.5	180.0	-15	6000	2,000	-	H	CS	3	Buried vessel with submersible pump installed.						Oily Water fire fighting foam unit to be included. Details to be provided later.
	11	V	505	HCU drain collection drum	-	-	-	-	-	-	-	-	-	-	-	-	3.5	180	-15	6000	2,000	-	H	CS	3	Buried vessel with submersible pump installed.						
	11	V	508	Clean Water Sump	-	-	-	-	-	-	-	-	-	-	-	-	3.5	180	-15	6000	2,000	-	H	CS	3	Buried vessel with submersible pump installed.						
				Utilities																													
	11	V	501	Continous Blowdown Drum (Steam Generation System)	-	-	-	-	-	-	-	-	-	-	-	-	5 / FV	180	-15	1306	400	-	V	CS	3.0							Preliminary Information
	11	V	502	Intermittent Blowdown Drum (Steam Generation Sysytem)	-	-	-	-	-	-	-	-	-	-	-	-	5 / FV	225	-15	1600	530	-	V	CS	3.0							Preliminary Information
	11	V	503	LLP Condensate Flash Drum	-	-	-	-	-	-	-	-	-	-	-	-	3.5/FV	170	-15		700	2,350	V	CS	3.0							Preliminary Information
	11	V	504	Fuel Gas Knockout Drum	-	-	-	-	-	-	-	-	-	-	-	-	8.5 / FV	80	-15	2400	800	-	V	CS	3.0							Preliminary Information
	11	V	506	Instrument Air Receiver	-	-	-	-	-	-	-	-	-	-	-	-	10.0	80	-15	-	2,200	7,700	V	CS (Epoxy coated OR hot galvanised)								10 mins holdup catering to HCU unit
	10	V	101	Vacuum Unit Feed Surge Drum	-	-	-	-	-	-	-	-	-	-	-	-	3.5/FV	365	-15	9,800	3,200		H	CS+410S CLAD	2.5	Mixing Nozzle						
	10	V	102	VDU Vacuum Drum	-	-	-	-	-	-	-	-	-	-	-	-	Information from Vacuum Package Vendor															Part of vacuum system package unit. Refer to Document No. 180480-HCU-010-31-551-0019
	10	V	103	Wash Oil Drum	-	-	-	-	-	-	-	-	-	-	-	-	3.5 / FV	400	-15		1,100	3,400	V	CS+410S CLAD	2.5							
	10	V	201	Fuel Gas Knock Out Drum													8.5	80	-15	2400	800		V	CS	3.0							Preliminary Information
	10	V	202	Tempered Water Expansion Drum	-	-	-	-	-	-	-	-	-	-	-	-	3.5	95	-15	3,600	1,200		H	CS	3.0							
	13	V	301	Acid Gas KO Drum	-	-	-	-	-	-	-	-	-	-	-	-	3.5	55	-15		762	2,550	V	CS	6.0	SS 316L Demister						
	13	V	302	Sour Gas KO Drum	-	-	-	-	-	-	-	-	-	-	-	-	3.5	100	-15		635	1,400	V	CS	6.0							
	13	V	303	Fuel Gas KO Drum	-	-	-	-	-	-	-	-	-	-	-	-	5.5	60	-15		406 (OD)	900	V	CS	3.0							
	13	V	304	HP Steam Drum	-	-	-	-	-	-	-	-	-	-	-	-	51.0	290	-15	3,200	1,067		H	CS	3.0							
	13	V	305	First Condenser Hydraulic Seal	-	-	-	-	-	-	-	-	-	-	-	-	3.5	343	-15	1,000	500		V	CS	3.0							

EQUIPMENT TAG NUMBER				DESCRIPTION	P&ID No:	Datasheet No:	TYPE	DUTY (MW)	SURFACE AREA (m^2)	CAPACITY / RATING (EACH)	Diff. HEAD (m)	Diff. Pressure (Bar)	Maximum Specific Gr	MOTORs (kW)			DESIGN CONDITIONS			DIMENSIONS / UNIT *(Estimated in italics)*			ORIENTATION. H or V	MATERIAL of CONST.	CA - mm	MISCELLANEOUS : INTERNALS / BAYS / No. OF FANS / LENGTH OF TUBES	PAINTING & INSULATION		CALCULATED WEIGHT per UNIT (Estimated in italics)		MR / Budget Price No.	REMARKS
	Unit	EQ. TYPE	Sequential Number											Steam / Gas / Electric / Diesel	Absorbed KW	Motor KW	PRESSURE - Barg	TEMP. MAX (°C)	TEMP. MIN (°C)	Length (T-T) mm	Width / ID-mm	Height (T-T) mm					SPEC	THK. mm	DRY - kg	TEST -kg		
	13	V	306	Second Condenser Hydraulic Seal	-	-	-	-	-	-	-	-	-	-	-	-	3.5	343	-15	1,000	500		V	CS	3.0							
	13	V	307	Final Condenser Hydraulic Seal	-	-	-	-	-	-	-	-	-	-	-	-	3.5	343	-15	1,000	500		V	CS	3.0							
	13	V	308	Degassing Air Receiver	-	-	-	-	-	-	-	-	-	-	-	-	10.0	100	-15		610	1,200	V	ASTM A-516	3.0							
	600	V	691	VR Cyclone			Separator										2 barg	470	-15		1,500	6,000	H	CS with 410SS internal cladding								New
	600	V	601	Main Frac Ohd Acc	-	-	-	-	-	-	-	-	-	-	-	-	As Existing	As Existing	-	-	As Existing	As Existing		As Existing								Existing Unit, no change anticipated
	600	V	602	Compressor KO Drum	-	-	-	-	-	-	-	-	-	-	-	-	As Existing	As Existing	-	-	As Existing	As Existing		As Existing								Existing Unit, no change anticipated
	600	V	603	HP Separator	-	-	-	-	-	-	-	-	-	-	-	-	As Existing	As Existing	-	-	As Existing	As Existing		As Existing								Existing Unit, no change anticipated
	600	V	604	Stabiliser Ohd Drum	-	-	-	-	-	-	-	-	-	-	-	-	As Existing	As Existing	-	-	As Existing	As Existing		As Existing								Existing Unit, no change anticipated
	600	V	605	Splitter Ohd Drum	-	-	-	-	-	-	-	-	-	-	-	-	As Existing	As Existing	-	-	As Existing	As Existing		As Existing								Existing Unit, no change anticipated
	600	V	606	Tempered Water Drum	-	-	-	-	-	-	-	-	-	-	-	-	As Existing	As Existing	-	-	As Existing	As Existing		As Existing								Existing Unit, no change anticipated
	600	V	654	LN Separator Drum	-	-	-	-	-	-	-	-	-	-	-	-	As Existing	As Existing	-	-	As Existing	As Existing		As Existing								Existing Unit, no change anticipated
	99	V	101	Fuel Gas Mixing Drum	-	-	-	-	-	-	-	-	-	-	-	-	As Existing	As Existing	-	-	As Existing	As Existing		As Existing								Existing - minor nozzle modification

Notes:

EQUIPMENT TAG NUMBER				DESCRIPTION	P&ID No:	Datasheet No:	TYPE	DUTY (MW)	SURFACE AREA (m²)	CAPACITY / RATING (EACH)	Diff. HEAD (m)	Diff. Pressure (Bar)	Maximum Specific Gravity	MOTORs (kW)			DESIGN CONDITIONS			DIMENSIONS / UNIT *(Estimated in italics)*			ORIENTATION, H or V	MATERIAL of CONST.	CA - mm	MISCELLANEOUS : INTERNALS / BAYS / No. OF FANS / LENGTH OF TUBES	PAINTING & INSULATION		CALCULATED WEIGHT per UNIT (Estimated in italics)		MR / Budget Price No.	REMARKS
	Unit	EQ. TYPE	Sequential Number											Steam / Gas / Electric / Diesel	Absorbed KW	Motor KW	PRESSURE - Barg	TEMP. MAX (°C)	TEMP. MIN (°C)	Length (T-T) mm	Width / ID-mm	Height (T-T) mm					SPEC	THK. mm	DRY - kg	TEST -kg		
				Reactors																													
	11	R	101	First Stage Reactor	-	-	-	-	-	-	-	-	-	-	-	-	169.0	454.0	-15.0	-	2900	26300	V	Shell & heads = 2 1/4 Cr-1 Mo or 2 1/4 Cr-1 Mo-V + 3mm 347 Wol, permanent internals 347 +		5 packed beds						
	11	R	102	Second Stage Reactor	-	-	-	-	-	-	-	-	-	-	-	-	165.5	427.0	-15.0	-	2900	16700	V	Shell & heads = 2 1/4 Cr-1 Mo or 2 1/4 Cr-1 Mo-V + 3mm 347 Wol, permanent internals 347 +		3 packed beds						
	13	R	301	Reaction Furnace	-	-	-	-	-	-	-	-	-	-	-	-	3.5	343	-15.0	6,900	1,372		H	CS	3.0							Refractory Lined, 265 mm thick Design Pressure 7 Barg @ 90% yield.
	13	R	302	First / Second Claus Reactor	-	-	-	-	-	-	-	-	-	-	-	-	3.5	343	-15.0	7,400	2,270		H	CS	3.0	SS Internals	HC					Refractory Lined
		SRU, catalyst		Alumina-based catalyst (Axens CR 3S, Alcoa DD-431, UOP S-2001)	-	-	-	-	-	9 m³	-	-	-	-	-	-	-	-	-	-	-	-										
		SRU, catalyst		Titanium Oxide catalyst (Axens CRS 31, Alcoa SRC 99ti, UOP S-7001)	-	-	-	-	-	3 m³	-	-	-	-	-	-	-	-	-	-	-	-										

Notes:

EQUIPMENT TAG NUMBER				DESCRIPTION	P&ID No:	Datasheet No:	TYPE	DUTY (MW)	SURFACE AREA (m^2)	CAPACITY / RATING (EACH)	Diff. HEAD (m)	Diff. Pressure (Bar)	Maximum Specific Gravity	MOTORs (kW)			DESIGN CONDITIONS					DIMENSIONS / UNIT *(Estimated in italics)*			ORIENTATION, H or V	MATERIAL of CONST.	CA - mm	MISCELLANEOUS : INTERNALS / BAYS / No. OF FANS / LENGTH OF TUBES	PAINTING & INSULATION		CALCULATED WEIGHT per UNIT (Estimated in italics)		MR / Budget Price No.	REMARKS
	Unit	EQ. TYPE	Sequential Number											Steam / Gas / Electric / Diesel	Absorbed KW	Motor KW	PRESSURE - Barg		TEMP. MAX (°C)		TEMP. MIN (°C)	Length (T-T) mm	Width / ID-mm	Height (T-T) mm					SPEC	THK. mm	DRY - kg	TEST -kg		
																	Tube	Shell	Tube	Shell													
				Heat Exchangers																														
	13	E	101	Feed/Product Exchanger	-	-	AFS	3.142	247.8	-	-	-	-	-	-	-	6.0/FV	6.0/FV	170	170	-15	-	914	-	H	Tube SS 316L Shell CS	3	6094 mm						Tube : NACE requirement MR0103
	13	E	102	Stripper Reboiler	-	-	AEU	8.963	457	-	-	-	-	-	-	-	5.0/FV	6.0/FV	180	170	-15	-	1,181	-	H	Tube CS Shell CS	3	6094 mm						Shell : NACE requirement MR0103
	14	E	201	LP Lean MDEA Heater	-	-	AES	0.043	1.1	-	-	-	-	-	-	-	14.0	10.8 / FV	155	180	-15	-	152	-	H	Tube CS Shell CS	3	6,096						Include 10% Design Margin on Duty, PWHT
	14	E	202	Lean/Rich MDEA Exchanger	-	-	AES	4.241	389	-	-	-	-	-	-	-	7.2	9.0	130	160	-15	-	1118	-	H	Tube 316L Shell CS	3	6,096						Include 10% Design Margin on Duty, NACE requirement MR0103
	14	E	203	Regenerator Reboiler	-	-	BEM	7.750	170	-	-	-	-	-	-	-	5.0 / FV	4.5 / FV	180	160	-15	-	813	-	H	Tube CS Shell CS	3	6,096						Include 10% Design Margin on Duty, NACE requirement MR0104
	14	E	204	Regenerator Overhead Trim Cooler	-	-	AES	0.0965	20	-	-	-	-	-	-	-	5.0	4.5 / FV	66	115	-15	-	356	-	H	Tube 316L Shell CS+3mm+316L clad		6,096						Include 10% Design Margin on Duty
	14	E	205	BFW Cooler	-	-	AES	0.121	6	-	-	-	-	-	-	-	27.7	36.0	120	180	-15	-	-	-	H	Tube CS Shell CS	3	Hairpin						Include 10% Design Margin on Duty
	11	E	101	Kero P/A / Oil Feed Exchanger	-	-	AES	1.4	180.00	-	-	-	-	-	-	-	12	16	260	260	-15	-	730	-	H	Tube: CS (14 gauge) Shell: CS + 3mm		6,096						TEMA Type, Area to be confirmed. Estimated for costing.
	11	E	102 A/B	Diesel / Oil Feed Exchangers	-	-	AES	2.9	250.00	-	-	-	-	-	-	-	10	16	273	260	-15	-	914	-	H	Tube: CS (14 gauge) Shell: CS + 3mm		6,096						TEMA Type, Area to be confirmed. Estimated for costing.
	11	E	103 A/B	First Stage Reactor Feed / Effluent Exchanger	-	-	DEU	23.0	688	-	-	-	-	-	-	-	175	160	428	454	-15	-	1,041	-	H	Tube: 321 (12 gauge) Shell: 2 1/4 Cr-1Mo + 3mm 347 wol		6,096						TEMA Type, Area to be confirmed. Estimated for costing.
	11	E	104 A/B	Second Stage Reactor Feed / Effluent Exchanger	-	-	DFU	12.9	627	-	-	-	-	-	-	-	173	160	400	427	-15	-	965	-	H	Tube: 321 (16 gauge) Shell: 2 1/4 Cr-1Mo + 3mm 347 wol		6,096						
	11	E	105	Combined Reactor Effluent / Frac Feed Exchanger	-	-	DFU	7.9	370	-	-	-	-	-	-	-	157	121	363	343	-15	-	1,143	-	H	Tube: 321 (16 gauge) Shell: CS + 4.5mm		6,096						
	11	E	106	Combined Reactor Effluent / MP Steam Generator	-	-	DKU	14.2	410	-	-	-	-	-	-	-	156	15	343	260	-15	-	940	-	H	Tube: 825 (16 gauge) Shell: CS + 3mm		6,096						
	11	E	107	HHPS Vapour / Recycle Gas Exchanger	-	-	DFU	8.6	133	-	-	-	-	-	-	-	187	155	232	288	-15	-	1,168	-	H	Tube: 1 1/4 Cr-1/2Mo (12 gauge) Shell: CS + 3mm		6,096						
	11	E	108	Lean Amine Heater	-	-	AES	0.3	8.00	-	-	-	-	-	-	-	6.9	5	260	260	-15	-	-	-	H	Tube: CS (SR U-bends) (14 gauge) Shell: CS + 3mm		Hairpin						TEMA Type, Area to be confirmed. Estimated for costing.
	11	E	109	CLPS Liquid / Kerosene Exchanger	-	-	AES	0.9	135.00	-	-	-	-	-	-	-	11.2	12.5	260	260	-15	-	686	-	H	Tube: CS (14 gauge) Shell: CS + 3mm		6,096						TEMA Type, Area to be confirmed. Estimated for costing.
	11	E	110	Kerosene P/A / CLPS Liquid Exchanger	-	-	AES	2.8	230.00	-	-	-	-	-	-	-	12.1	12	260	260	-15	-	800	-	H	Tube: CS (14 gauge) Shell: CS + 3mm		6,096						TEMA Type, Area to be confirmed. Estimated for costing.
	11	E	201	Product Stripper Overhead Water Cooler	-	-	AES	0.4	93.00	-	-	-	-	-	-	-	6.8	8.8	260	260	-15	-	965	-	H	Tube: CS (12 gauge) Shell: CS (per GN-9)		6,096						TEMA Type, Area to be confirmed. Estimated for costing.
	11	E	202	Heavy Kerosene Stripper Reboiler	-	-	BEM	1.4	34.00	-	-	-	-	-	-	-	3.7	19	250	260	-15	-	406	-	H	Tube: 410 (16 gauge) Shell: CS + 2.5mm 410S clad		6,096						TEMA Type, Area to be confirmed. Estimated for costing.
	11	E	203	Fractionator Feed / Diesel P/A Exchanger	-	-	AES	3.8	284.00	-	-	-	-	-	-	-	10	19	305	260	-15	-	965	-	H	Tube: CS (12 gauge) Shell: CS + 3mm		6,096						TEMA Type, Area to be confirmed. Estimated for costing.
	11	E	204	Kerosene Product Water Cooler	-	-	AES	0.1	21.00	-	-	-	-	-	-	-	9.6	12.5	260	260	-15	-	343	-	H	Tube: CS (12 gauge) Shell: CS + 3mm		6,096						TEMA Type, Area to be confirmed. Estimated for costing.
	11	E	301	Naphtha Stabilizer Feed / Diesel Product Exchanger	-	-	AES	1.5	48.00	-	-	-	-	-	-	-	14.1	10	260	260	-15	-	470	-	H	Tube: CS (14 gauge) Shell: CS + 3mm		6,096						TEMA Type, Area to be confirmed. Estimated for costing.
	11	E	302	Naphtha Stabilizer Overhead Water Cooler	-	-	AES	2.2	274.00	-	-	-	-	-	-	-	9	11.7	260	260	-15	-	965	-	H	Tube: CS (12 gauge) Shell: CS (PWHT) + 4.5mm		6,096						TEMA Type, Area to be confirmed. Estimated for costing.
	11	E	303	Naphtha Stabilizer Reboiler	-	-	BEM	2.1	37.00	-	-	-	-	-	-	-	11.9	19	195	343	-15	-	470	-	H	Tube: 410 (16 gauge) Shell: CS + 2.5mm 410S		6,096						TEMA Type, Area to be confirmed. Estimated for costing.
	11	E	304	Light Naphtha Product Water Cooler	-	-	AES	0.1	26.00	-	-	-	-	-	-	-	7.8	10	260	260	-15	-	450	-	H	Tube: CS (12 gauge) Shell: CS + 3mm		6,096						TEMA Type, Area to be confirmed. Estimated for costing.
	11	E	305	Naphtha Splitter Reboiler	-	-	BEM	3.0	64.00	-	-	-	-	-	-	-	3.8	19	175	320	-15	-	508	-	H	Tube: 410 (16 gauge) Shell: CS + 2.5mm 410S		6,096						TEMA Type, Area to be confirmed. Estimated for costing.
	11	E	306	Naphtha Splitter Feed / Naphtha Splitter Bottoms Exchanger	-	-	AES	0.6	24.00	-	-	-	-	-	-	-	6.2	15	280	260	-15	-	356	-	H	Tube: CS (14 gauge) Shell: CS + 3mm		6,096						TEMA Type, Area to be confirmed. Estimated for costing.
	11	E	307	Heavy Naphtha Product Water Cooler	-	-	AES	0.2	42.00	-	-	-	-	-	-	-	11.5	15	260	260	-15	-	457	-	H	Tube: CS (12 gauge) Shell: CS + 3mm		6,096						TEMA Type, Area to be confirmed. Estimated for costing.
				UTILITIES																														
	11	E	501	Blowdown Cooler (Steam Generation System)	-	-	AES	0.009	0.20	-	-	-	-	-	-	-	11.5	15	260	260	-15	-	-	-	H	CS CS		Hairpin						Estimate. Part of steam turbine system. To be sized by vendor.
	10	E	101	Cold Feed Pre-Heater	-	-	AES	4.0	512	-	-	-	-	-	-		6.8	23.2	235	240	-15	*7,300*	*1,650*		H	Carbon Steel Carbon Steel		6,096						Preliminary. For cost estimate only.
	10	E	105	HVGO PA Steam Generator	-	-	AKU	6.9	632	-	-	-	-	-	-		23.2	14.0	240	210	-15	7,300	2,350		H	Carbon Steel Carbon Steel		6,096						Preliminary. For cost estimate only.
	10	E	106	LVGO PA Cooler	-	-	AES	2.98	262	-	-	-	-	-	-		8.7	18.4	95	135	-15	7,300	850		H	Carbon Steel Carbon Steel		6,096						Preliminary. For cost estimate only.
	10	E	107	LVGO Product Cooler	-	-	AES	.75	62	-	-	-	-	-	-		8.7	18.4	95	135	-15	7,300	470		H	Carbon Steel Carbon Steel		6,096						Preliminary. For cost estimate only.
	10	E	108	HVGO Product Cooler	-	-	AES	6	676	-	-	-	-	-	-		8.7	23.2	95	291	-15	7,300	1,260		H	Carbon Steel Carbon Steel		6,096						Preliminary. For cost estimate only.
	10	E	109	Vacuum Residue Cooler	-	-	AES	6	315	-	-	-	-	-	-		8.7	26.0	95	398	-15	7,300	880		H	Carbon Steel Carbon Steel		6,096						Preliminary. For cost estimate only.
	10	E	110	LVGO PA Trim Cooler	-	-	AES	1.94	175	-	-	-	-	-	-		5.0	18.4	66	135	-15	7,300	680		H	Carbon Steel Carbon Steel		6,096						Preliminary. For cost estimate only.

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	Unit	EQ. TYPE	Sequential Number											Steam / Gas / Electric / Diesel	Absorbed KW	Motor KW	PRESSURE - Barg		TEMP. MAX (°C)		TEMP. MIN (°C)	Length (T-T) mm	Width / ID-mm	Height (T-T) mm					SPEC	THK. mm	DRY - kg	TEST -kg		
																	Tube	Shell	Tube	Shell														
	13	E	301	Waste Heat Boiler	-	-	Shell & Tube	3.10	120	-	-	-	-	-	-		3.5	51.0	343	290	-15		965		H	Carbon Steel Carbon Steel		6,096						Preliminary. For cost estimate only.
	13	E	302	First Sulphur Condenser	-	-	NEN	0.46	77	-	-	-	-	-	-		3.5	6.6	343	200	-15		864		H	Carbon Steel Carbon Steel		6,096						Preliminary. For cost estimate only.
	13	E	303	Second Sulphur Condenser	-	-	NEN	0.26	61	-	-	-	-	-	-		3.5	6.6	325	200	-15		864		H	Carbon Steel Carbon Steel		6,096						Preliminary. For cost estimate only.
	13	E	304	Final Sulphur Condenser	-	-	NEN	0.20	61	-	-	-	-	-	-		3.5	6.6	260	200	-15		864		H	Carbon Steel Carbon Steel		6,096						Preliminary. For cost estimate only.
	13	E	305	First Reheater	-	-	NEN	0.13	57	-	-	-	-	-	-		3.5	51.0	280	290	-15		533		V	Carbon Steel Carbon Steel		3,560						Preliminary. For cost estimate only.
	13	E	306	Second Reheater	-	-	NEN	0.12	57	-	-	-	-	-	-		3.5	51.0	265	290	-15		533		V	Carbon Steel Carbon Steel		3,560						Preliminary. For cost estimate only.
	13	E	307	Sulphur Cooler	-	-	AEU	0.02	5	-	-	-	-	-	-		15.0	15.0	184	184	-15		254		H	Carbon Steel Carbon Steel		3,660						Shell from DN 250 STD WT Pipe
	600	E	691A	VAC Residue / HGO Heat Exchanger			AES		230								14.9	66.9	280	205			914			CS CS		6096						New, Replaces E601 A
	600	E	692 A/B	VAC Residue / VFCR Heat Exchanger			AES		935								36.8	66.9	335	270			2000 x 2			347 SS (5% Cr - 0.5% Mo) CS		6096						New, Replaces E 602 A/B
	600	E	693	VAC Residue / Main Vacuum Flasher Bottom Heat Exchanger			AES		600								15.1	66.9	400	365			2300			347 SS (5% Cr - 0.5% Mo) 347 SS (5% Cr - 0.5% Mo)		6096						New, Replaces E603 A/B
	600	E	696	VFCR / MP Steam Generator			ATK		800								17.2	19.5	345	225			2600			CS CS		6096						New, Replaces E 606A/B
	600	E	697	VFCR / Process Steam Generator			ATK		700								34.6	6.8	230	175			2500			347 SS (5% Cr - 0.5% Mo) CS		6096						New, Replaces E 607 A/B
	600	E	698	VF Upper Pumparound			AES		80								4	2.5	300	*300*			965			CS CS		6096						New
	600	E	699	VF Lower Pumparound			AES		80								4	2.5	300	*300*			965			CS CS		6096						New
	~~600~~	~~E~~	~~601A/B~~	~~AR / diesel~~																														These exchangers are not required for the VBU or TGU after the HCU is in operation. However, there may be merit in retaining half of the heat up train so that the unit coulsd continue to operate on AR post HCU when the VDU is shut down. The logistics of options is under review.
	~~600~~	~~E~~	~~602A/B/C/D~~	~~LR / tar~~																														
	~~600~~	~~E~~	~~603A/B/C/D~~	~~LR / tar~~																														
	~~600~~	~~E~~	~~603E~~	~~LR / tar~~																														
	~~600~~	~~E~~	~~604~~	~~Tar / BFW~~																														
	~~600~~	~~E~~	~~605~~	~~Tar/Temp Water~~																														
	~~600~~	~~E~~	~~606A/B~~	~~BFW / tar~~																														
	~~600~~	~~E~~	~~607A/B~~	~~BFW / tar~~																														
	600	E	608	L Naphtha Cooler																														Existing Unit, no change anticipated
	600	E	609	C-601 Ohd Trim Cooler																														Existing Unit, no change anticipated
	600	E	610	HP Sep Trim Cooler																														Existing Unit, no change anticipated
	600	E	611	C-603 feed / C-603 bottoms																														Existing Unit, no change anticipated
	600	E	612A/B	C-603 bottoms / tar																														Existing Unit, no change anticipated
	600	E	613	Stab Ohd Trim Cooler																														Existing Unit, no change anticipated
	600	E	614	C-604 bottoms / gasoil																														Existing Unit, no change anticipated
	600	E	615	Diesel/BFW																														Existing Unit, no change anticipated
	600	E	655	V605 Offgas Coler																														Existing Unit, no change anticipated
	600	E	681	C-604 feed / C-604 bottoms																														Existing Unit, no change anticipated
	600	E	682	C-604 Reboiler																														Existing Unit, no change anticipated
	600	E	683	Heavy Naptha Trim Cooler																														Existing Unit, no change anticipated

Notes:

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	Unit	EQ. TYPE	Sequential Number											Steam / Gas / Electric / Diesel	Absorbed KW	Motor KW	PRESSURE - Barg	TEMP. MAX (°C)	TEMP. MIN (°C)	Length (T-T) mm	Width / ID-mm	Height (T-T) mm					SPEC	THK. mm	DRY - kg	TEST -kg		
				Aircoolers																													
	13	EA	101	Stripper Condenser	-	-	-	7.37	5016	-	-	-	-	Electric	25 each 4 (fans)	30 (each)	Tube: 3.5/FV	150	-15	-	-	-		Tube : Ti Al Finned, Header box : 316L								NACE
	14	EA	201	Regenerator Overhead Condenser	-	-	-	3.710	7259	-	-	-	-	Electric	30 each 2 (fans)	37 (each)	4.0 / FV	145.0	-15					Tube : Ti Al Finned, Header box : 316L								Include 20% Design Margin on Duty
	14	EA	202	Lean MDEA Cooler	-	-	-	3.150	5211	-	-	-	-	Electric	22 each 2 (fans)	30 (each)	9.0	130.0	-15					Tube : CS, PWHT, Header box : CS, PWHT								Include 20% Design Margin on Duty
	11	EA	101	HHPS Vapour Air Cooler	-	-	-	17.0	22400	-	-	-	-	Electric	27 each 6 (fans)	37 (each)	153.4	232	-15	-	-	-		Headers = 2205 + 1mm, Tubes = 2205 (14 gauge)								
	11	EA	102	HLPS Vapour Air Cooler	-	-	-	0.6	533	-	-	-	-	Electric	2.2 each 2 (fans)	3.7 (each)	31.7	288	-15	-	-	-		Header = CS + 4.5 mm, Tubes = CS (14 gauge)								
	11	EA	103	Backwash Oil Air Cooler	-	-	-	1.3	By Filter Vendor	-	-	-	-	Electric	32 each 2 (fans)	37 (each)	15.3	260	-15	-	-	-		Header = CS + 3 mm, Tubes = CS (14 gauge)								
	11	EA	201	Product Stripper Overhead Air Cooler	-	-	-	7.8	12127	-	-	-	-	Electric	30 each 4 (fans)	37 (each)	8.8	260	-15	-	-	-		Header = CS (per GN-9) + 4.5 mm, Tubes = CS (12 gauge)								
	11	EA	202	Fractionator Overhead Air Cooler	-	-	-	18.4	22000	-	-	-	-	Electric	25 each 6 (fans)	30 (each)	3.5	260	-15	-	-	-		Header = CS (PWHT) + 4.5 mm, Tubes = CS (12 gauge)								
	11	EA	203	Kerosene Product Air Cooler	-	-	-	2.0	2104	-	-	-	-	Electric	11 each 2 (fans)	15 (each)	12.5	260	-15	-	-	-		Header = CS + 3 mm, Tubes = CS (14 gauge)								
	11	EA	204	Fractionator Bottoms Product Air Cooler	-	-	-	0.3	160	-	-	-	-	Electric	1 each 2 (fans)	1.5 (each)	19	295	-15	-	-	-		Header = CS + 4.5 mm, Tubes = CS (14 gauge)								
	11	EA	205	Fractionator Bottom Startup Aircooler	-	-	-	11.7	12000	-	-	-	-	Electric	30 each 4 (fans)	37 (each)	TBA	TBA	-15	-	-	-		Header = CS + 4.5 mm, Tubes = CS (14 gauge)								
	11	EA	301	Naphtha Splitter Overhead Air Cooler	-	-	-	3.4	7000	-	-	-	-	Electric	30 each 2 (fans)	37 (each)	3.5	260	-15	-	-	-		Header = CS + 4.5 mm, Tubes = CS (12 gauge)								
	11	EA	302	Heavy Naphtha Air Cooler	-	-	-	0.7	1100	-	-	-	-	Electric	8.6 each 1 (fans)	11 (each)	15	260	-15	-	-	-		Header = CS + 3 mm, Tubes = CS (14 gauge)								
	11	EA	401 A	Make-Up H2 1st Stage Air Cooler - Train A	-	-	-	1.0	1500	-	-	-	-	Electric	5 each 2 (fans)	7.50 (each)	56.6	260	-15	-	-	-		Headers = CS + 3mm, Tubes = CS (12 gauge)								
	11	EA	401 B	Make-Up H2 1st Stage Air Cooler - Train B	-	-	-	1.0	1500	-	-	-	-	Electric	5 each 2 (fans)	7.50 (each)	56.6	260	-15	-	-	-		Headers = CS + 3mm, Tubes = CS (12 gauge)								
	11	EA	402 A	Make-Up H2 2nd Stage Air Cooler - Train A	-	-	-	1.3	1800	-	-	-	-	Electric	10 each 2 (fans)	15 (each)	103.2	260	-15	-	-	-		Headers = CS + 3mm, Tubes = CS (12 gauge)								
	11	EA	402 B	Make-Up H2 2nd Stage Air Cooler - Train B	-	-	-	1.3	1800	-	-	-	-	Electric	10 each 2 (fans)	15 (each)	103.2	260	-15	-	-	-		Headers = CS + 3mm, Tubes = CS (12 gauge)								
	11	EA	403	Make-Up H2 Spillback Air Cooler	-	-	-	0.6	865	-	-	-	-	Electric	6.8 each 1 (fans)	7.5 (each)	32.1	260	-15	-	-	-		Headers = CS + 3mm, Tubes = CS (12 gauge)								
	11	EA	220	Diesel Drier Air Cooler				5.7	6000	-	-	-	-	Electric	25 each 4 (fans)	30 (each)	15	209	-15	-	-	-										Preliminary design
	10	EA	201	Tempered Water Air Cooler				9.72	15750					Electric	4 x 28	37 (each)	8.7	95	-15	9,144	12,840			CS		2 Bays						Preliminary design
	13	EA	301	Steam Condenser			-	0.60	550					Electric	2.2 each 2 (fans)	3.7 (each)	6.6	200	-15	1,750	1,500											Surface area is finned surface area.
	600	EA	691	Additional TW Cooler					5298								8.7							CS								New
	~~600~~	~~EA~~	~~604~~	~~Kero Cooler~~																												Demolish
	600	EA	601A-F	C-601 Overheads (w E609)																												Existing Unit, no change anticipated
	600	EA	602	Feed to V-603 (w E610)																												Existing Unit, no change anticipated
	600	EA	605	Diesel Cooler																												Existing Unit, no change anticipated
	600	EA	606A/B	C-603 Overheads (wE613)																												Existing Unit, no change anticipated
	600	EA	607A/B	C-604 Overheads																												Existing Unit, no change anticipated
	600	EA	608	H Nap Cooler																												Existing Unit, no change anticipated

EQUIPMENT TAG NUMBER				DESCRIPTION	P&ID No:	Datasheet No:	TYPE	DUTY (MW)	SURFACE AREA (m^2)	CAPACITY / RATING (EACH)	Diff. HEAD (m)	Diff. Pressure (Bar)	Maximum Specific Gravity	MOTORs (kW)			DESIGN CONDITIONS			DIMENSIONS / UNIT *(Estimated in italics)*			ORIENTATION. H or V	MATERIAL of CONST.	CA - mm	MISCELLANEOUS : INTERNALS / BAYS / No. OF FANS / LENGTH OF TUBES	PAINTING & INSULATION		CALCULATED WEIGHT per UNIT (Estimated in italics)		MR / Budget Price No.	REMARKS
	Unit	EQ. TYPE	Sequential Number											Steam / Gas / Electric / Diesel	Absorbed KW	Motor KW	PRESSURE - Barg	TEMP. MAX (°C)	TEMP. MIN (°C)	Length (T-T) mm	Width / ID-mm	Height (T-T) mm					SPEC	THK. mm	DRY - kg	TEST -kg		
	600	EA	609	Tempered Water Cooler																											Existing Unit, no change anticipated

Notes:

EQUIPMENT TAG NUMBER				DESCRIPTION	P&ID No:	Datasheet No:	TYPE	DUTY (MW)	SURFACE AREA (m^2)	CAPACITY / RATING (EACH) M3/hr	Dif. HEAD (m)	Dif. Pressure (Bar)	Specific Gravity	VISCOSITY (mPa.s)	Operating Temp (°C)	LIQUID PUMPED	VAPOUR PRESSURE (BAR) (abs)	HAZARDOUS / TOXIC / CARCINOGENIC (Name)	H_2S / HAZARDOUS SUBSTANCE / Corrosive (ppmv)	Maximum Specific Gravity	MOTORs (kW)			DESIGN CONDITIONS				DIMENSIONS / UNIT *(Estimated in italics)*			ORIENTATION, H or V	MATERIAL of CONST.	CA - mm	MISCELLANEOUS : INTERNALS / BAYS. / No. OF FANS / LENGTH OF TUBES	PAINTING & INSULATION		CALCULATED WEIGHT per UNIT (Estimated in italics)		MR / Budget Price No.	REMARKS
	Unit	EQ. TYPE	Sequential Number																			Steam / Gas / Electric / Diesel	Absorbed KW	Motor KW	PRESSURE - Barg	Max Suction Pressure - Barg	TEMP. MAX (°C)	TEMP. MIN (°C)	Length (T-T) mm	Width / ID-mm	Height (T-T) mm						SPEC	THK. mm	DRY - kg	TEST -kg		
				Pumps																																				
	13	P	101	Recovered Oil Pump	-	-	Centrifugal	-	-	5	27.0	2.1	0.808							0.808	Electric	0.40	0.55	6.5		75	-15	-	-	-		Casing : CS Impeller : 12 Cr									
	13	P	102 A/B	Stripper Feed Pumps	-	-	Centrifugal	-	-	54	46.0	4.4	0.982							0.982	Electric	9.2	11	7.3		60	-15	-	-	-		Casing : Duplex SS 2507 Impeller : Duplex SS 2507								NACE API 610	
	13	P	103 A/B	Stripper Bottoms Pumps	-	-	Centrifugal	-	-	48	28.6	2.6	0.931							0.931	Electric	4.7	5.5	6.0		170	-15	-	-	-		Casing : CS Impeller : 12 Cr	3.0								
	13	P	104 A/B	Stripper Reflux Pumps	-	-	Centrifugal	-	-	13	39.2	3.6	0.928							0.928	Electric	2.4	3.7	5.0		130	-15	-	-	-		Case Hastealloy C Impeller Hastealloy C									
	14	P	201A/B	Regenerator Reflux Pumps	-	-	Centrifugal	-	-	8.0	43.3	4.0	0.949	0.440	40.0	Sour Water	1.800	H2S/ NH3	123200 / 64000	0.949	Electric	2.2	3.7	11.0		75.0	-15	-	-	-		Casing : 316L Impeller : 316L								NACE API 610	
	14	P	202A/B	Lean MDEA to HCU Circulation Pumps	-	-	Centrifugal	-	-	30.0	95.6	9.7	1.032	3.440	40.0	Lean MDEA	0.0657	H2S	670.0	1.032	Electric	23.3	30	14.0		75.0	-15	-	-	-		Casing : 316L Impeller : 316L									
	14	P	203A/B	Lean MDEA to Refinery Circulation Pumps	-	-	Centrifugal	-	-	61.0	152.6	15.5	1.032	3.440	40.0	Lean MDEA	0.0657	H2S	670.0	1.032	Electric	75.6	90	21.0		75.0	-15	-	-	-		Casing : CS Impeller : 316L									
	14	P	204A/B	MDEA Filtration Pumps	-	-	Centrifugal	-	-	10.0	51.8	5.2	1.032	3.440	40.0	Lean MDEA	0.0657	H2S	670.0	1.032	Electric	2.1	3.7	8.0		75.0	-15	-	-	-		Casing : CS Impeller : 316L									
	14	P	205	Precoat Filtration Pump	-	-	Centrifugal	-	-												Electric							-	-	-										Part of Filtration Package (13-PK-202). Information by vendor.
	14	P	206	Continuous Antifoam Injection Pump	-	-	Reciprocating	-	-												Electric							-	-	-										Part of Antifoam Injection Package (13-PK-201). Information by vendor.
	14	P	207	Intermittent Antifoam Injection Pump	-	-	Reciprocating	-	-												Electric							-	-	-										Part of Antifoam Injection Package (13-PK-201). Information by vendor.
	14	P	208A/B	MDEA Sump Pump	-	-	Centrifugal	-	-	10.0	65.6	6.6	1.032	3.440	40.0	Lean MDEA	0.0657	H2S	670.0	1.032	Electric	2.7	3.7	12.0		155.0	-15	-	-	-		Casing : CS Impeller : 316L								Warehouse Spare	
	14	P	209A/B	Regenerator Bottom Pumps	-	-	Centrifugal	-	-	94.0	24.8	2.4	0.963	0.560	129.0	Lean MDEA	2.3	H2S	670.0	0.963	Electric	11.6	15	9.0		160.0	-15	-	-	-		Casing : CS Impeller : 316L									
	11	P	101 A/B	First Stage Reactor Feed Pumps	-	-	Centrifugal	-	-	153.0 / 168.4	2179.4	170.1	0.8	2.6	215.0	HC's	<0.01			-	Electric	1223.6	1400	227	6	260	-15	-	-	-		S-1								Inlet 215°C & 3.5 bar(g), Outlet 218°C & 173.3 bar(g), flowrate 121869 kg/hr, *see material balance	
	11	P	102 A/B	Second Stage Reactor Feed Pumps	-	-	Centrifugal	-	-	123.6 / 136.0	2467.9	168.0	0.7	0.5	266.0	HC's	0.62			-	Electric	976.60	1200	224	6	280	-15	-	-	-		S-6								Inlet 266°C & 3.5 bar(g), Outlet 269°C & 171.3 bar(g), flowrate 85895 kg/hr, *see material balance	
	11	P	103 A/B	Injection Water Pumps	-	-	Reciprocal	-	-	16.7 / 18.3	1586.2	151.2	1.0	0.4	52.0	Water	0.14		-	-	Electric	118.366	150	202	6	260	-15	-	-	-		18Cr-BN									
	11	P	104 A/B	Lean Amine Pumps	-	-	Centrifugal	-	-	19.6 / 21.5	1514.4	148.2	1.0	0.4	56.0	Lean Amine	0.17	H2S	3225.0	-	Electric	136.4	150	198	6	260	-15	-	-	-		S-3									
	11	P	105 A/B	Backwash Oil Pumps	-	-	Centrifugal	-	-	115.1 / 138.1	120.9	9.4	0.8	2.6	215.0	HC's	<0.01	S	5760.0	-	Electric	55.7	75	12	6	260	-15	-	-	-		TBA									
	11	P	106 A/B	HVGO Cold Feed Pumps																						260													
	11	P	201 A/B	Product Stripper Reflux Pumps	-	-	Centrifugal	-	-	58.6 / 70.4	121.7	7.5	0.6	0.2	59.0	HC's	7.31	H2S	1876	-	Electric	22.4	30		9	260	-15	-	-	-		S-8									
	11	P	202 A/B	Product Stripper Bottoms Pump	-	-	Centrifugal	-	-	280.0 / 336.0	143.7	9.8	0.7	0.3	207.0	HC's	8.21			-	Electric	140.3	160	22	9	260	-15	-	-	-		S-1									
	11	P	203 A/B	Fractionator Reflux Pumps	-	-	Centrifugal	-	-	127.0 / 152.5	90.2	6.3	0.7	0.4	50.0	HC's	0.32			-	Electric	41.2	55		4	260	-15	-	-	-		S-1									
	11	P	204 A/B	Fractionator OVHD Water Pumps	-	-	Centrifugal	-	-	7.4 / 8.9	59.4	5.8	1.0	0.5	50.0	Water	0.12			-	Electric	2.2	3.7		4	260	-15	-	-	-		S-8									
	11	P	206 A/B	Kerosene Product Pumps	-	-	Centrifugal	-	-	35.9 / 39.5	172.0	10.1	0.6	0.1	232.0	HC's	2.01			-	Electric	17.1	22		5	260	-15	-	-	-		S-6									
	11	P	207 A/B	Kerosene Pumparound Pumps	-	-	Centrifugal	-	-	177.5 / 213.0	88.9	5.4	0.6	0.2	205.0	HC's	1.91			-	Electric	49.5	55	13	6	260	-15	-	-	-		S-1									
	11	P	208 A/B	Diesel Product Pumps	-	-	Centrifugal	-	-	105.0 / 115.4	199.5	12.8	0.7	0.3	259.0	HC's	3.01			-	Electric	63	75		4	305	-15	-	-	-		S-6									
	11	P	209 A/B	Diesel Pumparound Pumps	-	-	Centrifugal	-	-	143.7 / 172.5	55.0	3.3	0.6	0.2	287.0	HC's	2.01			-	Electric	24.5	30	9	5	305	-15	-	-	-		S-6									
	11	P	210 A/B	Fractionator Bottoms Pumps	-	-	Centrifugal	-	-	137.7 / 216.7	197.2	13.6	0.6	0.3	344.0	HC's	3.11			-	Electric	126.1	150	22	4	360	-15	-	-	-		S-6									
	11	P	301 A/B	Naphtha Splter Reflux Pumps	-	-	Centrifugal	-	-	42.8 / 51.4	92.9	5.8	0.634	0.2	50.0	HC's	1.01			-	Electric	12.7	18.5	11	4	260	-15	-	-	-		S-1									
	11	P	302 A/B	Heavy Naphtha Pumps	-	-	Centrifugal	-	-	29.5 / 35.4	144.3	8.7	0.6	0.2	160.0	HC's	3.01			-	Electric	13.2	18.5	15	4	260	-15	-	-	-		S-1									
	11	P	303 A/B	Naphtha Stabilizer Reflux Pumps	-	-	Centrifugal	-	-	25.8 / 31.0	126.9	6.5	0.5	0.1	38.0	HC's	10.11	H2S	9551	-	Electric	8.6	11		12	260	-15	-	-	-		S-8									
	11	P	503 A/B	Oil transfer pumps	-	-	Submersible Centrifugal	-	-	3 / 4	82	5				HC's				-	Electric	0.6	1.1	8		80						CS								Preliminary estimate only.	
	11	P	504 A/B	Water transfer pumps	-	-	Submersible Centrifugal	-	-	5 / 6	54	5								-	Electric	1.1	1.5	8		80						CS								Preliminary estimate only.	
	11	P	505 A/B	HCU blow down pump	-	-	Submersible Centrifugal	-	-	5 / 6	82	5				HC's				-	Electric	0.6	1.1	8		80						CS								Preliminary estimate only.	
	11	P	506 A/B	Clean Water Transfer Pump	-	-	Submersible Centrifugal	-	-	5 / 6	82	5								-	Electric	1.1	1.5	8		80						CS								Preliminary estimate only.	
	11	P	501 A/B	LLP Condensate Pump	-	-	Centrifugal	-	-	5.5	80	4.4	0.98							0.98	Electric	2.2	3.7	9.5		150	-15					Casing : CS Impeller : 12% Cr									
	999	P	502 A/B	Cooling Water Circulation Pumps	-	-	Centrifugal	-	-	1400.0	52	4.1	1.0	0.8	40.0	Water	0.04			0.99	Electric	160	235	8.0		120						CS / CI									

EQUIPMENT TAG NUMBER				DESCRIPTION	P&ID No:	Datasheet No:	TYPE	DUTY (MW)	SURFACE AREA (m^2)	CAPACITY / RATING (EACH) M3/hr	Diff. HEAD (m)	Diff. Pressure (Bar)	Specific Gravity	VISCOSITY (mPa.s)	Operating Temp (°C)	LIQUID PUMPED	VAPOUR PRESSURE (BAR) (abs)	HAZARDOUS / TOXIC / CARCINOGENIC (Name)	H_2S / HAZARDOUS SUBSTANCE / Corrosive (ppmv)	Maximum Specific Gravity	MOTORs (kW)			DESIGN CONDITIONS				DIMENSIONS / UNIT *(Estimated in italics)*			ORIENTATION, H or V	MATERIAL of CONST.	CA - mm	MISCELLANEOUS : INTERNALS / BAYS. / No. OF FANS / LENGTH OF TUBES	PAINTING & INSULATION		CALCULATED WEIGHT per UNIT (Estimated in italics)		MR / Budget Price No.	REMARKS
	Unit	EQ. TYPE	Sequential Number																		Steam / Gas / Electric / Diesel	Absorbed KW	Motor KW	PRESSURE - Barg	Max Suction Pressure - Barg	TEMP. MAX (°C)	TEMP. MIN (°C)	Length (T-T) mm	Width / ID-mm	Height (T-T) mm					SPEC	THK. mm	DRY - kg	TEST -kg		
	600	P	691 A/B	Gasoil Furnace Feed			Centrifugal			12	566	50.0									Electric	40.8	55									CS casing SS internals								New x 2 pumps
	600	P	692 A/B	VF Pumparound			Centrifugal			22	28	2.5									Electric	2.3	3.7									CS casing SS internals								New x 2 pumps
	600	P	693 A/B	VF Wash Oil			Centrifugal			10	15	1.5									Electric	0.3	.12									CS casing SS internals								New x 2 pumps
	600	P	694 A/B	VF Bottoms Rundown			Centrifugal			130	97	10.0									Electric	81.2	110									CS casing SS internals								New x 2 pumps
	600	P	695 A/B	VF Bottoms Quench			Centrifugal			80	49	5.0									Electric	22.2	30									CS casing SS internals								New x 2 pumps
	600	P	696	Additional TW Pump			Centrifugal			50	41	4.0									Electric	10.4	15									CS								New
	600	P	601 A/B/C	Visbreaker Heater Charge Pump			Centrifugal			150		43.3									Electric		490									CS								Replace Impeller
	~~600~~	~~P~~	~~602A/B~~	~~C-601 bottoms~~																																			Demolish
	~~600~~	~~P~~	~~622A/B~~	~~C-601 bottoms~~																																			Demolish
	~~600~~	~~P~~	~~605A/B~~	~~C-602B bottoms~~																																			Demolish
	600	P	603A/B	Gasoil pump-around			Centrifugal			232		15.4									Electric		220									CS casing SS internals								Replace Impeller
	600	P	604A/B	C-602A bottoms																	Electric																		Existing Unit, no change anticipated
	600	P	606A/B	C-601 reflux																	Electric																		Existing Unit, no change anticipated
	600	P	607A/B	Naphtha ex V-601																	Electric																		Existing Unit, no change anticipated
	600	P	608A/B	Sour water																	Electric																		Existing Unit, no change anticipated
	600	P	609A/B	C-603 feed																	Electric																		Existing Unit, no change anticipated
	600	P	610A/B	C-603 reflux																	Electric																		Existing Unit, no change anticipated
	600	P	611A/B	LPG ex V-604																	Electric																		Existing Unit, no change anticipated
	600	P	612A/B	Heavy naphtha																	Electric																		Existing Unit, no change anticipated
	600	P	613A/B	Light naphtha																	Electric																		Existing Unit, no change anticipated
	600	P	614A/B	Tempered Water Pump																	Electric																		Existing Unit, no change anticipated
	600	P	626	Slop Oil																	Electric																		Existing Unit, no change anticipated
	10	P	101 A/B	VDU Feed Pumps			CENTRIFUGAL	-	-	310.2	164.0	12.5	0.780	0.936	320	HC's	3.11	S	8700	0.780	Electric	151.7	185	20.3		334	-15					12 % chromium steel								The flow rate indicated is the rated flow. Preliminary pump absorbed power.
	10	P	102 A/B	LVGO Pumps			CENTRIFUGAL	-	-	205.0	111.2	8.9	0.820	2.333	121	HC's	0.02	S	5760	0.820	Electric	85.9	110	18.4		135	-15					316 austenitic stainless steel								The flow rate indicated is the rated flow. Preliminary pump absorbed power.
	10	P	103 A/B	HVGO Pumps			CENTRIFUGAL	-	-	787.7	157.3	12.3	0.790	0.654	277	HC's	0.02	S	5760	0.790	Electric	305.8	335	23.2		291	-15					12 % chromium steel								The flow rate indicated is the rated flow. Preliminary pump absorbed power.
	10	P	104 A/B	Wash Oil Pumps			CENTRIFUGAL	-	-	70.6	223.0	17.2	0.780	2.119	385	HC's	0.03	S	14500	0.780	Electric	57.2	75	26.1		398	-15					12 % chromium								The flow rate indicated is the rated flow. Preliminary pump absorbed power.
	10	P	105 A/B	Vacuum Residue Pumps			CENTRIFUGAL	-	-	158.5	181.7	15.1	0.850	2.374	340	HC's	0.03	S	14500	0.850	Electric	103.1	132	26.0		354	-15					12 % chromium								The flow rate indicated is the rated flow. Preliminary pump absorbed power.
	10	P	106 A/B	Slop Oil Pumps				-	-							HC's	0.02																					Part of vacuum system package unit. To be confirmed based on 10-PK-102 design.
	10	P	107 A/B	VDU Sour Water Pumps				-	-								0.02	H_2S	30																				Part of vacuum system package unit. To be confirmed based on 10-PK-102 design.
	10	P	108 A/B	Wash Oil Internal Reflux Pumps			CENTRIFUGAL	-	-	72.8	87.9	7.6	0.780	2.000	352	HC's	0.03	S	14500	0.780	Electric	22.6	30	13.8		366	-15					12 % chromium								The flow rate indicated is the rated flow. Preliminary pump absorbed power.
	10	P	109 A/B	Cold Feed Pump			CENTRIFUGAL	-	-	55.0	52.0	4.7	0.918			HC's	<0.01			0.918	Electric	9.6	15	6.8		115	-15					CS								The flow rate indicated is the rated flow. Preliminary pump absorbed power.
	10	P	201 A/B	Tempered Water Pump			CENTRIFUGAL	-	-	475.0	29.7	2.8	0.972			Water	<0.01			0.972	Electric	46.0	55	8.7		95	-15													The flow rate indicated is the rated flow. Preliminary pump absorbed power.
	13	P	301 A/B	Sour Water Pump A/B			Centrifugal	-	-	2	22.1	2.2	1.00							1.00	Electric	0.12	0.25	6.6			-15					Casing and Impeller Duplex								Intermittent
	13	P	302	SWS Gas Sour Pump			Centrifugal	-	-	2	22.5	2.2	1.00							1.00	Electric	0.12	0.25	6.6			-15					Casing and Impeller Duplex								Intermittent
	13	P	303 A/B	Sulphur Degassing Pump A/B			Submerged Centrifugal	-	-	1	57.0	9.9	1.77							1.77	Electric	0.33	0.55	13.5			-15					Casing CS Impellor CI								Continuous
	13	P	304 A/B	Tempered Water Circ Pump A/B			Centrifugal	-	-	2	30.0	3.0	1.00							1.00	Electric	0.16	0.25	7.6			-15					Casing CS Impellor 12% Cr								Intermittent

Notes:

EQUIPMENT TAG NUMBER				DESCRIPTION	P&ID No:	Datasheet No:	TYPE	DUTY (MW)	SURFACE AREA (m^2)	CAPACITY / RATING (EACH)	Diff. HEAD (m)	Diff. Pressure (Bar)	Maximum Specific Gravity	MOTORs (kW)			DESIGN CONDITIONS			DIMENSIONS / UNIT *(Estimated in italics)*			ORIENTATION, H or V	MATERIAL of CONST.	CA - mm	MISCELLANEOUS : INTERNALS / BAYS / No. OF FANS / LENGTH OF TUBES	PAINTING & INSULATION		CALCULATED WEIGHT per UNIT (Estimated in italics)		MR / Budget Price No.	REMARKS
	Unit	EQ. TYPE	Sequential Number											Steam / Gas / Electric / Diesel	Absorbed KW	Motor KW	PRESSURE - Barg	TEMP. MAX (°C)	TEMP. MIN (°C)	Length (T-T) mm	Width / ID-mm	Height (T-T) mm					SPEC	THK. mm	DRY - kg	TEST -kg		
				Compressors																												
	11	K	101	Recycle Gas Compressor			Centrifugal			43,508 / 47,859		26.6	3.9	Steam																		
	11	K	401 A/B	Make-Up H2 Compressor			Reciprocating 3 stage			4,296 /		24.7/ 44.6/ 80.0	2.1	Electric																		
	600	K	601 A/B	Fractionator Off-Gas Compressor (existing)																												Add minimum flow bypass line from vapor ex V-603 to Inlet V-602, possibly revamp.
	13	K	301 A/B	Combustion Air Blower						4560 Nm^3/h		0.9		Electric	152	185.0																Continuous
	13	K	302 A/B	Degassing Air Compressor						18.4 Nm^3/h		7.3		Electric	2.4	3.0																Continuous

Notes:

EQUIPMENT TAG NUMBER				DESCRIPTION	P&ID No:	Datasheet No:	TYPE	DUTY (MW)	SURFACE AREA (m^2)	CAPACITY / RATING (EACH)	Diff. HEAD (m)	Diff. Pressure (Bar)	Maximum Specific Gravity	MOTORs (kW)			DESIGN CONDITIONS			DIMENSIONS / UNIT *(Estimated in italics)*			ORIENTATION, H or V	MATERIAL of CONST.	CA - mm	MISCELLANEOUS : INTERNALS / BAYS / No. OF FANS / LENGTH OF TUBES	PAINTING & INSULATION		CALCULATED WEIGHT per UNIT (Estimated in italics)		MR / Budget Price No.	REMARKS
	Unit	EQ. TYPE	Sequential Number											Steam / Gas / Electric / Diesel	Absorbed KW	Motor KW	PRESSURE - Barg	TEMP. MAX (°C)	TEMP. MIN (°C)	Length (T-T) mm	Width / ID-mm	Height (T-T) mm					SPEC	THK. mm	DRY - kg	TEST -kg		
				Heater - Furnace																													
	11	F	101	First Stage Reactor Feed Furnace				4.4																									
	11	F	102	Second Stage Reactor Feed Furnace				3.4																									
	11	F	201	Fractionator Feed Furnace			Single Fired	20.8																									
	600	F	601 A	Gasoil Cracking Furnace			Cabin	22.7 MW																	A271 TP 304N / A200 T5 / A200 T11								Retube for lower duty requirement of 7.0 MW with tubes as per existing
	600	F	601 B	Residue Cracking Furnace			Cabin	22.7 MW																	A271 TP 304N / A200 T5 / A200 T11								Retube for lower duty requirement of 3.0 MW with smaller tube of higher grade to handle higher temperatures
	10	F	101	Vacuum Unit Charge Heater			Horizontal Tube Cabin	24.76	968.1								13.5/ FV	560						A335 Gr.P9	*3.0*							The heat duty indicated is the designed heat absorbed by the process fluid only.Design fluid temperature is 4310C and the surface area indicated is for process coil.

Notes:

EQUIPMENT TAG NUMBER				DESCRIPTION	P&ID No:	Datasheet No:	TYPE	DUTY (MW)	SURFACE AREA (m²)	CAPACITY / RATING (EACH)	Diff. HEAD (m)	Diff. Pressure (Bar)	Maximum Specific Gravity	MOTORs (kW)			DESIGN CONDITIONS			DIMENSIONS / UNIT *(Estimated in italics)*			ORIENTATION, H or V	MATERIAL of CONST.	CA - mm	MISCELLANEOUS : INTERNALS / BAYS / No. OF FANS / LENGTH OF TUBES	PAINTING & INSULATION		CALCULATED WEIGHT per UNIT (Estimated in italics)		MR / Budget Price No.	REMARKS
	Unit	EQ. TYPE	Sequential Number											Steam / Gas / Electric / Diesel	Absorbed KW	Motor KW	PRESSURE - Barg	TEMP. MAX (°C)	TEMP. MIN (°C)	Length (T-T) mm	Width / ID-mm	Height (T-T) mm					SPEC	THK. mm	DRY - kg	TEST -kg		
				Tanks																													
	13	TK	101	Stripper Feed Surge Tank	-	-	CONE ROOF	-	-	1291.6 m³	-	-	-	-	-	-	0.5	60	-15		13,000	11,000		CS (Lined)	3.0							Flake pigment vinyl ester.
	14	TK	201	MDEA Storage Tank			CONE ROOF			125 m^3							0.02/-0.007	85.0	-15		4,000	9,950										
	14	TK	202	Antifoam Storage Tank			Vendor to confirm. Required for 95 m³/hr of MDEA circulation																										Part of Antifoam Injection Package (14-PK-201). Information by vendor.
	14	TK	203	Filtration Precoat Tank			Vendor to confirm. Required for 10 m³/hr of MDEA circulation.																										Part of Filtration Package (13-PK-202). Information by vendor.
	10	TK	302	LVGO Storage Tank			CONE ROOF			11600 m³							0.02/-0.007	95	-15													storage required allows for a 2 weeks holding time around the HCU. Preliminary
	10	TK	303	Vacuum Residue Storage Tank			CONE ROOF			26400 m³							0.02/-0.007	155	-15													Preliminary.
	13	TK	301	Sulphur Surge Tank	-	-	-	-	-	20 m³	-	-	-	-	-	-	1.0	185	-15	5,300	2,270		H	304SS		316L						
	13	TK	302	Sulphur Storage Tank	-	-	-	-	-	75 m³	-	-	-	-	-	-	0.0	150	-15	5,000	4,500		H	CS	3	316l						130 TONNES
	999	TK	501 A/B	Cooling Tower - CUP project capacity required 4500 m³/hr.						Estimated (2 new cells of 1400 each)																						

Notes:

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	Unit	EQ. TYPE	Sequential Number											Steam / Gas / Electric / Diesel	Absorbed KW	Motor KW	PRESSURE - Barg	TEMP. MAX (°C)	TEMP. MIN (°C)	Length (T-T) mm	Width / ID-mm	Height (T-T) mm					SPEC	THK. mm	DRY - kg	TEST -kg		
				Miscellaneous																													
	11	FT	101	Feed Filter						152.9 cu m/hr							16	260	-15					Shell and heads = CS + 3mm, internals 315								
	11	X	201	Diesel Drying System						100 m3/h low sulphur Diesel							3.5	343													Diesel Drying Vendor to confirm/provide details
				Pre Filter -2 Units						68460 kg/h							10	260		1858	457	-	H								
				Diesel Coalescer - 2 Units						68460 kg/h							10	260			711	1,016	V								
	11	DS	501	Total MP Steam Desuperheater						BFW: 443 kg/hr MS: 22410 kg/hr							15	260	-15												
	11	X	501	Recycle gas compressor stream turbine and auxillary package																											Refers to the HCU recycle gas compressor vendor.
	14	FT	201	Main MDEA Filter						Vendor to confirm. Required for 10 m³/hr of MDEA circulation.																					Part of Filtration Package (14-PK-202). Information by vendor.
	14	FT	202	Charcoal Filter						Vendor to confirm. Required for 10 m³/hr of MDEA circulation.																					Part of Filtration Package (14-PK-202). Information by vendor.
	14	FT	203	Cartridge Filter						Vendor to confirm. Required for 10 m³/hr of MDEA circulation.																					Part of Filtration Package (14-PK-202). Information by vendor.
	14	MX	201	Antifoam Tank Mixer						Vendor to confirm. Required for 10 m³/hr of MDEA circulation.																					Part of Filtration Package (14-PK-202). Information by vendor.
	13	PK	101	Corrossion Inhibitor Package																											
	600	PK	601	VDU Ejector System																											Vacuum system package unit - 2 stage ejector system with liquid ring pump. Capable of maintaing 20milibars in a Vacuum Flash Column. Flash Column throughput is 140 m3/h
	600	FT	691A/B	VF Washoil Filters						10 m3/h																					New
	600	FT	692A/B	Main Frac Washoil Filters						20 m3/h																					New
	600	FT	693A/B	P693 Filters						35 m3/h																					New
	600	FT	694A/B	P695 Filters						35 m3/h																					New
	10	PK	102	VDU Vacuum system Package																											Part of vacuum system package unit. Refer to Document No. 180480-HCU-010-31-551-0019
	10	**PK**	**101**	**VDU Offgas H2S Removal Package**																											Design not finalised yet
				VDU off gas booster fan			Centrifugal			497 Nm³/h		0.5	MW= 31	Electric	11.5	15.0	2.0	77					CS Casing SS316L cylinders or gears								Contains 5.2% H2S, 2.6 % O2 and 6% H2O.
				Absorbent Stripper Column	-	-	Packed Column	-	-	-	-	-	-	-	-	-	4.0/FV	170	-15		700	9000	V	Carbon steel, 6 mm CA. Top (from 0.6 m below feed) CS + 3.0 mm + Clad 316L								NACE requirement MR0103
				Absortion Column	-	-	Packed Column	-	-	-	-	-	-	-	-	-	3.5/FV	170	-15		650	8000	V	Carbon steel, 6 mm CA. Top (from 0.6 m below feed) CS + 3.0 mm + Clad 316L								NACE requirement MR0103
				Absorbent Stripper Reflux Drum	-	-	-	-	-	-	-	-	-	-	-	-	4.0/FV	170	-15		700	2,100	V	CS+316L Clad	3	Mesh Pad MOC of Internals : 316L						NACE requirement MR0103
				Reflux Cooler	-	-	AES	0.31	8.1	-	-	-	-	-	-	-	4.0/FV	170	-15	3048	292	-	H	Tube SS 316L Shell CS	3	3048 mm						Tube : NACE requirement MR0103
				Absorbent Stripper Reboiler	-	-	AEU	1.41	50	-	-	-	-	-	-	-	4.0/FV	170	-15	6095	445	-	H	Tube CS Shell CS	3	6095 mm						
				Absorbent Cooler	-	-	AES	0.69	12	-	-	-	-	-	-	-	3.5/FV	170	-15	3048	330	-	H	Tube SS 316L Shell CS	3	3048 mm						Tube : NACE requirement MR0103
				Absorbent Stripper Condenser	-	-	-	0.15	109.3 (Extended)	-	-	-	-	-	-	-	Tube: 3.5/FV	150	-15	-	-	-		Tube : Ti Al Finned, Header box : 316L		1829 mm Tube Length, 1 Bays, 2 Rows						NACE
				Stripped Water Air Cooler	-	-	-	1.68	2746 (Extended)	-	-	-	-	-	-	-	Tube: 6.0	170	-15	-	-	-		CS	3	4267 mm Tube Length, 2 Bays, 4 Rows						NACE
				Absorbent Pumps	-	-	Centrifugal	-	-	7	40.0	3.6	0.930	Elec	1.8	2.2	7.0	170	-15	-	-	-		Casing : Duplex SS 2507 Impeller : Duplex SS 2507								NACE API 610
				Sour water recycle Pumps	-	-	Centrifugal	-	-	19	47.2	4.6	0.986	Elec	4.1	5.5	7.0	170	-15	-	-	-		Casing : Duplex SS 2507 Impeller : Duplex SS 2507								NACE API 610
				Absorbent Reflux Pump	-	-	On/Off pump	-	-	0.3	51.2	4.4	0.872	Elec	0.04	0.12	7.0	170	-15	-	-	-		Casing : Duplex SS 2507 Impeller : Duplex SS 2507								NACE API 610
	10	DS	201	MP Steam Desuperheater						BFW: 330 kg/hr MS: 6000 kg/hr																					

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	Unit	EQ. TYPE	Sequential Number											Steam / Gas / Electric / Diesel	Absorbed KW	Motor KW	PRESSURE - Barg	TEMP. MAX (°C)	TEMP. MIN (°C)	Length (T-T) mm	Width / ID-mm	Height (T-T) mm					SPEC	THK. mm	DRY - kg	TEST -kg		
	13	FT	301	Air filter						18.4 Nm³/h							13.0	200														Cleanable
	13	J	301	Sulphur Surge Tank Ejector													6.6	200														
	13	BR	301	Reaction Furnace Burner																												
	13	DR	301 A/B	Degassing Air Dryer						18.4 Nm³/h																						
				Utilities																												
				Cooling tower Chemical dosing system																												Sized by vendor, based on the additional matching capacity required.
				Waste Water Treatment System																												To be upgraded.
				Fuel Gas metering system						31.6 tons/hr							26.5	95														GTCC to have own metering system of capacity 7.5 tons/hr

Notes:

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	Unit	EQ. TYPE	Sequential Number											Steam / Gas / Electric / Diesel	Absorbed KW	Motor KW	PRESSURE - Barg	TEMP. MAX (°C)	TEMP. MIN (°C)	Length (T-T) mm	Width / ID-mm	Height (T-T) mm					SPEC	THK. mm	DRY - kg	TEST -kg		
				Others																													
	12	PK	101	HYDROGEN UNIT						45000 Nm³/hr																						Vendor Package Unit
				Tail Gas Treating Unit (TGTU)						Based on differential cost of new sulfur plant capacity of 50 Tons/day (from existing 30 Tons/day)																						

Notes:

EQUIPMENT LIST REQUIREMENTS

Meeting: 27th April 2007

PR/MR **Process**

TW **Electrical Requirements**
Absorbed Power & Motor (Nameplate) Power kW
Assume for Estimate Aborbed Power 80% of Motor Power. Electrical will verify Motor Power in subsequent revisions of equipment list only major items checked for estimate.
Heaters what Type - Steam / Water / Electric
Air Coolers - No of Fans & Motor Size kW.

LA **Layout Requirements**
Indicate on vessels if Vertical or Horizontal
Pumps type Centrifugal / Canned etc.
Air Coolers - Number of Bays

ZC/MP **Mechanical Requirements**
Specific Gravity - Highest Maximum.
Mechanical will verify critical items i.e. reactor weights / compressor sizing for estimate.

JF/DS **Estimating Requirements**

Columns & Vessels: Design Pressure (Bar), Design Temp (°C), Inside Diameter (m), Tan to Tan (m), Skirt Length, Material (i.e. CS - Carbon Steel) and Scope of Internals i.e. No. of Trays, Type & Material.
Shell & Tube Exchangers: Surface Area (m²), Material for Shell / Tubes, TEMA Type, Shell / Tube Design Pressure (Bar) & Tube Length (m).
Air Coolers: Extended Surface Area (m2), Material for tube bundles & Design Pressure (Bar).
Fired Heaters: Duty (MW), Design Pressure (Bar) & Tube Materials.
Electric Heaters: Duty (kW), Material & Design Pressure (Bar).
Pumps: Type (Centrifugal/ Reciprocating / etc.), Duty (m³/hour), Differential Pressure (Bar), Motor Size (kW), Max Specific Gravity & Material.
Boilers: Tonnes of Steam / Hour, Superheat Temp (°C)
Compressors: Type (Centrifugal/ Reciprocating / Turbo Expander), Gas / Motor Driver, Rated Motor Size (kW) & Material.
Storage Tanks: Capacity (m³), Material (CS/Rubber Lined/SS) & Type where applicable (Cone / Floating Roof).
Sphere Launchers / Receivers: Line Size (Inches) & Material.
Generators: Duty (kw) & Type (Diesel/Gas).
Miscellaneous: Capacity m³/hour.

Format of Equipment List

The Equipment List is purely going to be a Mechanical Equipment List.
After debating alternative formats from PFD & Statoil - Conclusion was that primary user of equipment list currently is estimating - therefore modify Company proposed standard (Unit 1).