APPENDIX -A – Tables & Charts

A. ABBREVIATIONS OF PIPSIM SOFTWARE.

No	Abbreviation	Stand for
1	STB	Stoke Tank Barrel
2	W/C	Water Ratio in Oil
3	LGR	Liquid Gas Ratio
4	GOR	Gas Oil Ratio
5	API	American Petroleum Institute
6	Sm3/d	Standard Cubic Meter per day
7	Std	Standard
8	$mmscf$	Million Standard Cubic Feet
9	Scf/STB	Standard Cubic Feet / Stoke Tank Bralls (solution gas oil ratio)
10	$Gas.S.G$	Gas Specific Gravity
11	Water .S.G	Water Specific Gravity
12	BS&W	Basic Sediment and Water
13	KPAA	Kilo Pascal Atmospheric
14	WT	Wall thickness
15	ID	Inner Diameter
16	A T	Ambient Temperate
17	P Q Curve	Pressure / Discharge Quantity Curve
18	J	Junction
19	B	Branch
20	m	Meter
21	mm	Millimeter
22	Km	Kilo Meter
23	In	Inch
24	C^0	Celsius

Field	Length/m	Tie-in point /m	Diameter /Inches	Wall thickness/mm	Oil Temp /C°
FPF # 01 - Unity	4670.9	0	20	7.8	78
FPF # 02 - MUNGA	28080	4670.9	12	9.5	72
FPF # 03 ELNAR	170	35252.4	10	7.14	82
FPF#04 ELTOOR	19998.7	39678.7	10	7.14	74
FPF # 05- TOMA SOUTH	370	39681.6	10	7.4	80
Booster Pump Station	End point	-	20	7.4	75

C .Fields pumps specification

Location	Pump type	No of stage	No of pumps Running	Pump Name	Pump Capacity M3/hr
FPF-01 Unity	Centrifugal	3 Stage	1	SULZER	250
FPF-02 MUNGA	Centrifugal	5 Stage	1	Flow serve	160
FPF-03 ELNAR	Centrifugal	Single Stage	1	SULZER	108
FPF-04 ELTOOR	Screw		1	BORNEMANN	70
FPF-05 TOMA SOUTH	Centrifugal	Single Stage	2	SULZER	108
Booster out	Centrifugal	2 Stage	1	SULZER	730

D .PQ data for SULZER pump 250M3/hr FPF # 01- Unity

FPF No #1	Flow rate– m3/hr	Head (m)	Flow rate– m3/d	Pressure (KPA)
Unity FPF # 1	0	*340*	*0*	2856
SULZER pump 250M3/hr	5	*339*	*120*	2847.6
	15	*338.5*	*360*	2843.6
	25	*336*	*600*	2839.8
	40	*335*	*960*	2822.4
	50	*335*	*1200*	2814
	60	*334*	*1440*	2814
	75	*334*	*1800*	2805.6
	80	*333*	*1920*	2805.6
	95	*332*	*2280*	2797.2
	100	*332*	*2400*	2788.8
	105	*332*	*2520*	2788.8
	106.2	*331.4*	*2548.8*	2783.7
	115	*331*	*2760*	2782
	125	*330*	*3000*	2780.4
	150	*332*	*3600*	2772
	165	*329*	*3960*	2763.6
	175	*328*	*4200*	2755.2
	179.8	*326.2*	*4315.2*	2740.08
	185	*235*	*4440*	2746.8
	200	*324*	*4800*	2721.6
	205	*323*	*4920*	2713
	215	322	5160	2704
	230	*320*	*5280*	2688
	225	*319*	*5400*	2679.6
	230	*318*	*5520*	2671.2
	235	*316*	*5640*	2654.4
	240	*314*	*5760*	2637.6
	250	*313*	*6000*	2545.2
	252.1	*309.5*	*6050.4*	2536
	260	*302*	*6240*	2520
	275	300	6600	2519
	300	288	*7200*	2430
	325	*274*	*7800*	2301
	335	*269*	*8040*	2259.6

E .PQ data for pump of FPF # 02- MUNGA

MUNGA FPF # 2	Flow rate - m3/hr	Head (m)	Flow rate - m3/d	Pressure (KPA)
Flowserve pump 160 M3/hr	0	*604.2*	*0*	5173
	0	*604.2*	*0*	5196
	25	*600*	*600*	5160
	44	*592*	*1056*	5091
	44.8	*591.2*	*1075*	5084
	83.3	*576.4*	*1999.2*	4957.04
	84	*575*	*2016*	4945
	100	*566.8*	*2400*	4788.5
	119.3	*553.1*	*2863.2*	4758.4
	125	*541.9*	*3000*	4660
	150.3	*533.6*	*3607.2*	4588.9
	155.3	*523.6*	*3840*	4502.9
	160	*517.4*	*4200*	4449.6
	175	*510*	*4536*	4386
	189	*500*	*4591.2*	4300
	191.3	*495.3*	*5400*	4259.8
	225	*450*	*5395*	3870
	224.4	*449.9*	*5385.6*	3869.14
	226	*420*	*5424*	3612
	240	*410*	*5760*	3526
	256.4	*401.6*	*6153*	3453.8
	260	*400*	*6240*	3440

F. PQ data for pump of - FPF # 03- ELNAR

ELNAR (FPF #3)	Flow rate– m3/hr	Head (m)	Flow rate–m3/d	Pressure (KPA)
SULZER Pump -108 M3/hr	0	*228*	*0*	1901.2
	25	*227*	*600*	1891.6
	48.97	*223.78*	*1175.3*	1864.8
	50	*224*	*1200*	1866.6
	75	*216*	*1800*	1799.9
	77.16	*213.67*	*1851.8*	1780.5
	77.56	*219.5*	*1861.4*	1829.1
	100	*121*	*2400*	1766.6
	105.61	*204.80*	*2534.64*	1705.9
	106.61	*210.96*	*2558.6*	1758
	116.57	*201.83*	*2797.7*	1681.4
	125	*209*	*3000*	1740.9

	150	*194*	*3600*	1616.6
	172.59	*183.32*	*4142*	1527.6
	175	*180*	*4200*	1499.9

G .PQ data for pump of - FPF # 04- ELTOOR

ELTOOR (FPF 4)	Flow rate– m3/hr	Pressure (bar)	Flow rate– m3/d	Pressure (KPA)
BORNEMANN pump – positive displacement 70 M3/hr	102.7	*0*	*2464.8*	0
	98.7	*2.5*	*2368.8*	250
	96.1	*5*	*2306.4*	500
	93.5	*7.5*	*2244*	750
	89.6	*10*	*2150.4*	1000
	86.5	*12.5*	*2076*	1250
	82.3	*15*	*1975.2*	1500
	73	*17.5*	*1752*	1750
	69.1	*20*	*1658.4*	2000
	65.2	*22.5*	*1564.8*	2250
	62.6	*25*	*1502.4*	2500

H .PQ data for pump of FPF # 5- TOMA SOUTH

TOMA SOUTH (FPF 5	Flow rate–m3/hr .1pump	Head (m)	Flow rate m3/d .2pump	Pressure (KPA)
SULZER Pump 2pumps running .108 M3/hr	0	*228*	*0*	1901.2
	25	*227*	*1200*	1891.6
	48.97	*223.78*	*2350*	1864.8
	50	*224*	*2400*	1866.6
	75	*216*	*3600*	1799.9
	77.16	*213.67*	*3703.6*	1780.5
	77.56	*219.5*	*3722.8*	1829.1
	100	*121*	*4800*	1766.6
	105.61	*204.80*	*5069.28*	1705.9
	106.61	*210.96*	*5117.2*	1758
	116.57	*201.83*	*5595.4*	1681.4
	125	*209*	*6000*	1740.9
	150	*194*	*7200*	1616.6
	172.59	*183.32*	*8284*	1527.6
	175	*180*	8400	1499.9

I. The Readings during the normal operation on11/07/2011 at suction 550 KPA.

Location	Actual Pump Discharge pressure KPA	Actual Pipeline Pressure KPA	Actual Flow Rate M3/hr
FPF #01 UNITY	1440	700	210
FPF # 2-MUNGA	1200	825	64
FPF # 03 ELNAR	1830	600	95
FPF # 4- ELTOOR	1095	630	52
FPF # 5-TOMA SOUTH	1630	480	175
BOOSTER PUMP STATION	4009	810	580

J. The readings during the abnormal operation on 11/7/2011at suction pressure 711 KPA.

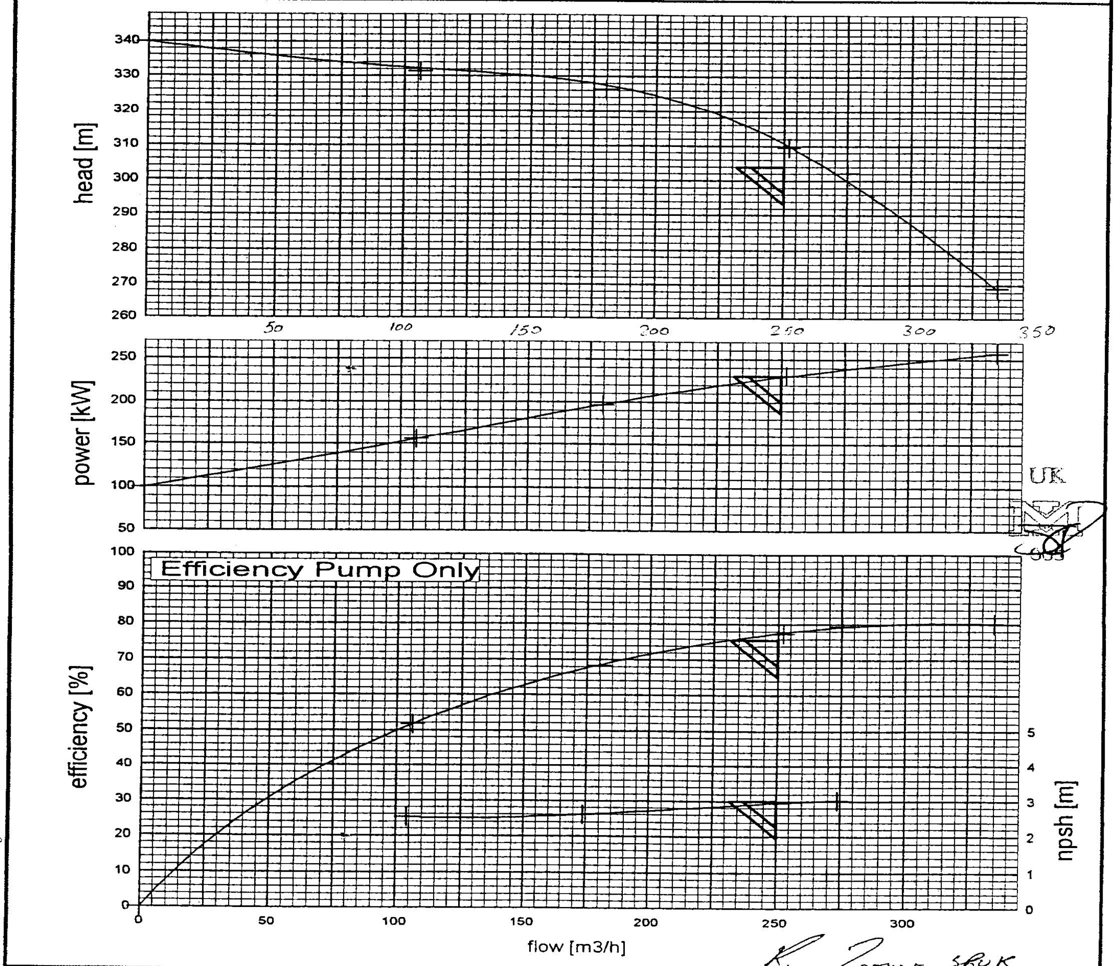
Location	Actual Pump Discharge pressure KPA	Actual Pipeline Pressure KPA	Actual Flow Rate M3/hr
FPF #01 UNITY	1662	907	200
FPF # 2-MUNGA	1421	910	60
FPF # 03 ELNAR	1835	774	87
FPF # 4- ELTOOR	850	750	46
FPF # 5-TOMA SOUTH	1660	708	165
BOOSTER PUMP STATION	711		

K – PQ, Power and η curves for Unity Transfer Pump

SULZER PUMPS — **Official Performance Test**

Client	China Petroleum	Speed [rpm]	2960	Section: 7
Project	Unity Crude Transfer	Quantity [m3/h]	250.0	
Pump Service	Crude Oil Transfer	Head [m]	303.80	Page 2
Pump Type	MSDD 6x8x11/3s	Power [kW]	230.20	
Tag No.	P-7001F	Efficiency [%]	75.50	
Manufacturers Order No.	38357	NPSH 3% [m]	3.00	
Chit No(s).	4-104.495.194a	Temperature [°C]	60.00	
Impeller Dia [m] 1st Stg	0.2890	Specific Gravity	.84	
Impeller Dia [m] Fol Stg(s)	2-3 = 0.2890	Kinematic Viscosity [m2/s]	0.000008700	

Drawn by : N.Credland Date : 22 May 2001	Remarks :



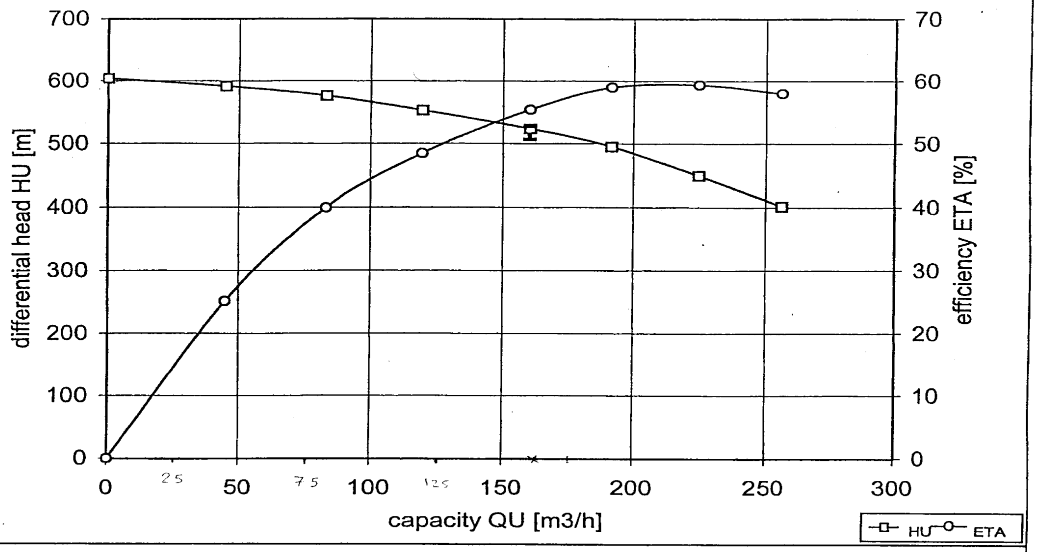
Curve No. 4-104.451. 554

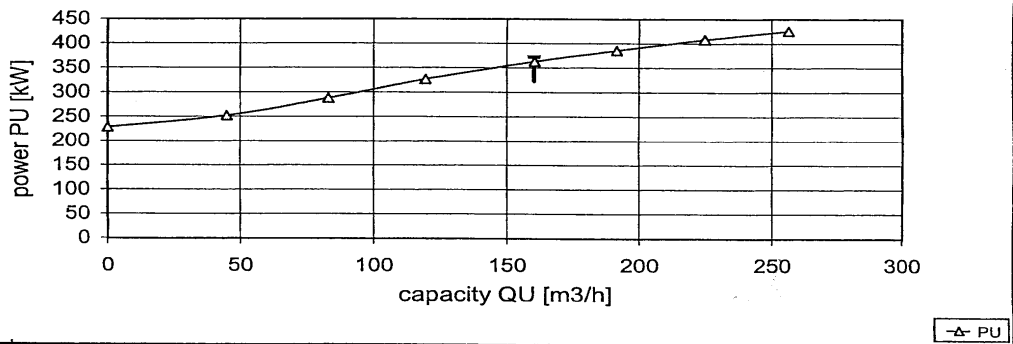
38357ma1.PTF

L. PQ, Power and η Curves for MUNGA Transfer Pump

Flowserve Pump Division / IDP *Munga* Brunn/Austria

test record for performance tests (**Q-H-eta**) on centrifugal pumps page 1 of 2

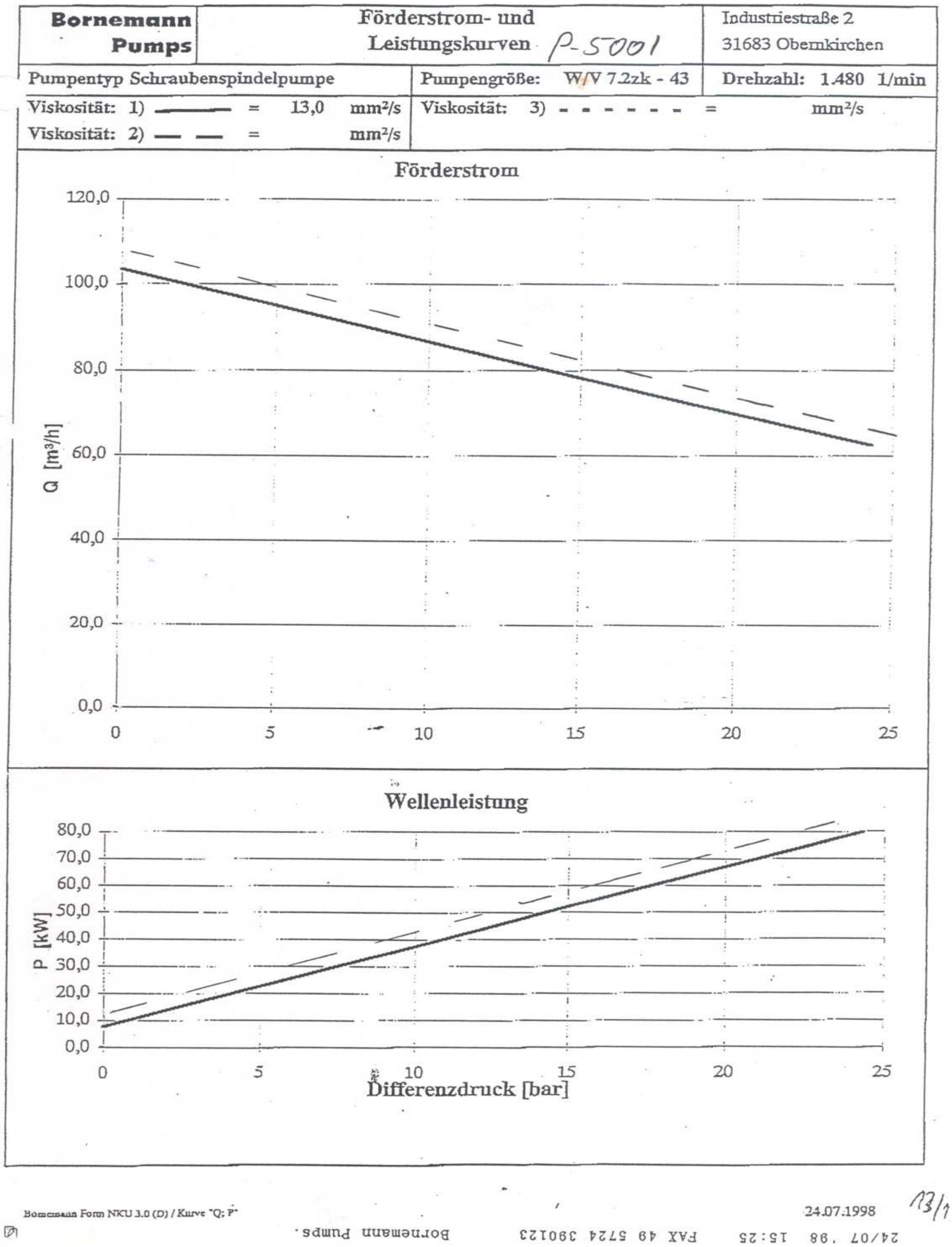




pump type:	6WXB-12B5	customer:	Petrofac International Ltd.
impeller diameter:	318 / 285 mm form: A	customer order number:	162 3003
serial. number:	G201218/03	item number:	P8001 C
order number:	G201218	remarks:	
pump:	3		
test number:	31		
date:	24.01.2002		
guaranteed values:			
QN:	160 m3/h		
HN:	517,4 m		
ETA:	55,3 %		
PN:	358 kW	tolerance for guarantee values:	API 610/8th ed.
speed:	2950 rpm		

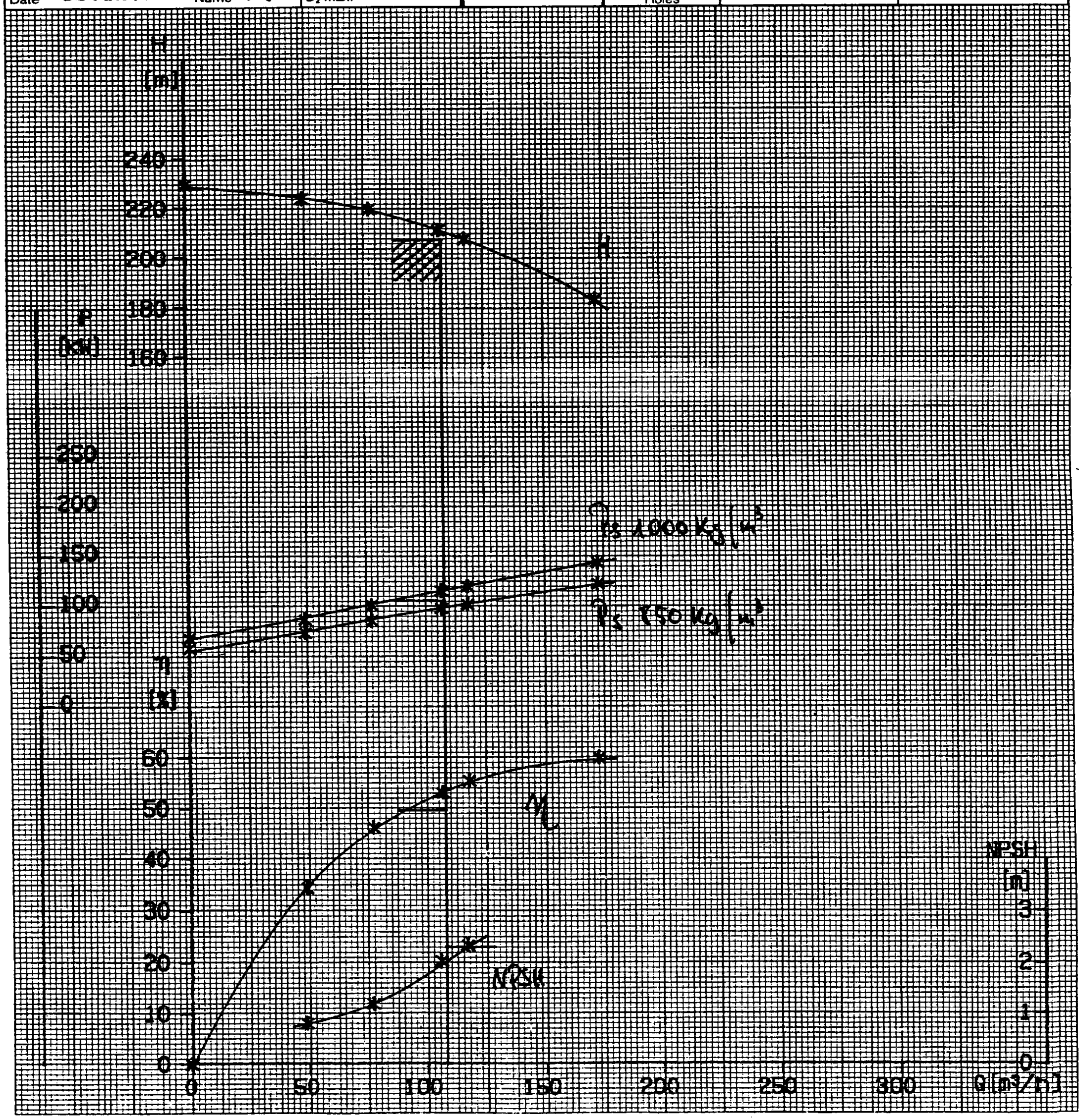
QUALITY CONTROL
Qualitätskontrolle (QC)
Ingersoll-Dresser Pumpe GmbH Austria

M. PQ, Power and η Curves for ELTOOR Transfer Pump



N-PQ, Power and η Curves for TOMA South & ELNAR Transfer Pumps

SULZER PUMPEN	Zeichnung-Nr. / Drawing-No.	Material / Material	C.-Nr. / C. No. 1-1.1-98453/1
Abnahme-Prüfkurve / Test curve	Laufrad / Impeller: 2-083409	1.4008	Typ / Type ZE 80-4450
Kunde / Customer: CHINA PETROL. ENG.	Leitrad / Diffuser		
Auftrags-Nr. / Order No.	Gehäuse / Casing		Kennwort / Code: SUDAN
Bestell-Nr. / Indent No.			
Pos.-Nr. / Item No.: P-6001 A	D_2 ausgef. / D_2 design. Ø 406	Schfl. / Vane Ø 406	Protokoll Nr. / Test Report No. 1 — vom / dated 16.12.98
gez.: / sig.:	D_2 min. / D_2 min. Ø	Schfl. / Vane Ø	n = 2975 1/min. — i = 1 Stufen / Stages
Datum / Date 16.12.98 — Name / Name	D_2 max. / D_2 max. Ø	Entlastung: Scheibe / Kolben, Rückschaufeln, Einzel / Balancing: Disc / Piston, Back Vanes, Holes	DN_s 100 mm — DN_d 80 mm



O -PQ, Power and η Curves For TOMA SOUTH Booster Pump Station.

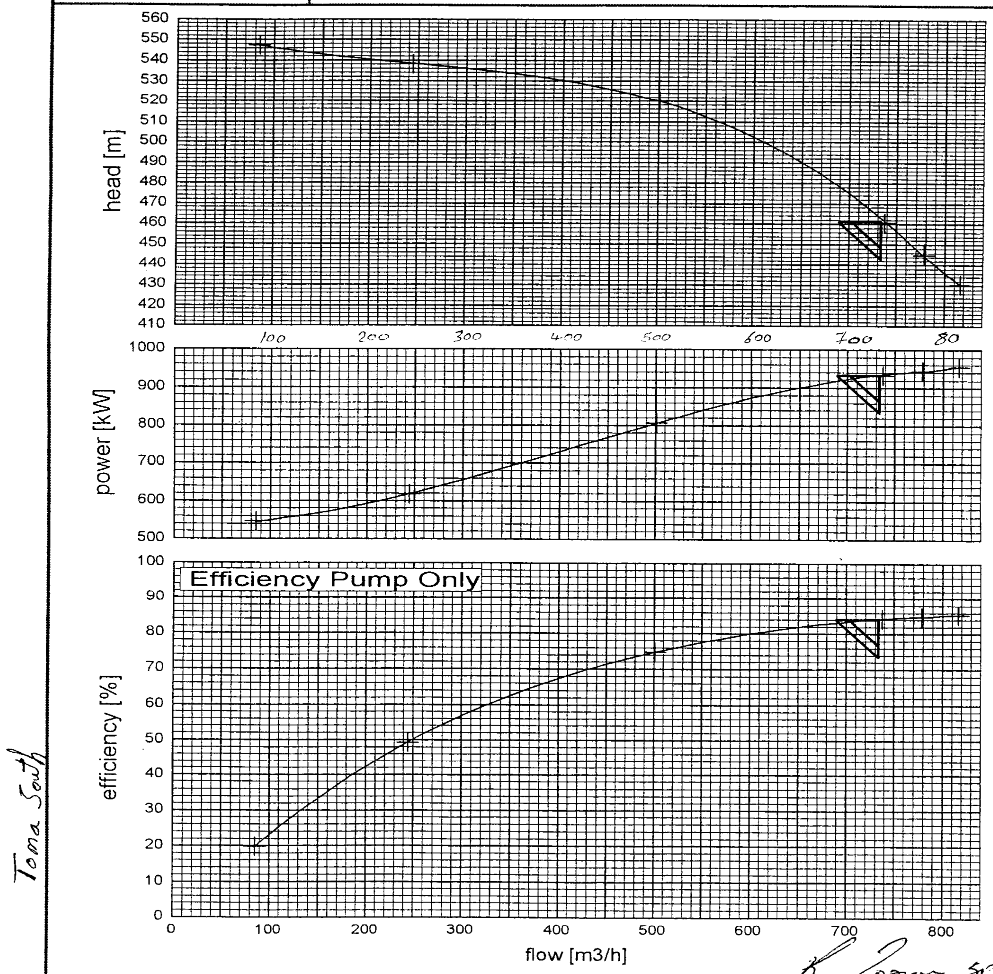
SULZER PUMPS — **Official Performance Test**

Client	China Petroleum	Speed [rpm]	2987
Project	Toma South	Quantity [m3/h]	734.0
Pump Service	Crude Oil Transfer	Head [m]	461.00
Pump Type	MSDD 10x10x14.5/3s	Power [kW]	933.00
Tag No.	P-4101 B	Efficiency [%]	84.00
Manufacturers Order No.	38358	NPSH 3% [m]	6.50
Chit No(s).	4-104.495.197a	Temperature [°C]	60.00
Impeller Dia [m] 1st Stg	0.3573	Specific Gravity	.85
Impeller Dia [m] Fol Stg(s)	2-3 = 0.3573, 0-0 = 0	Kinematic Viscosity[m2/s]	0.000012000

Section: 7
Page 31

Drawn by : N.Credland
Date : 14 Jun 2001

Remarks :



Curve No. 4-104.451. 581

UK

38358ma2.PTF

14.6.01

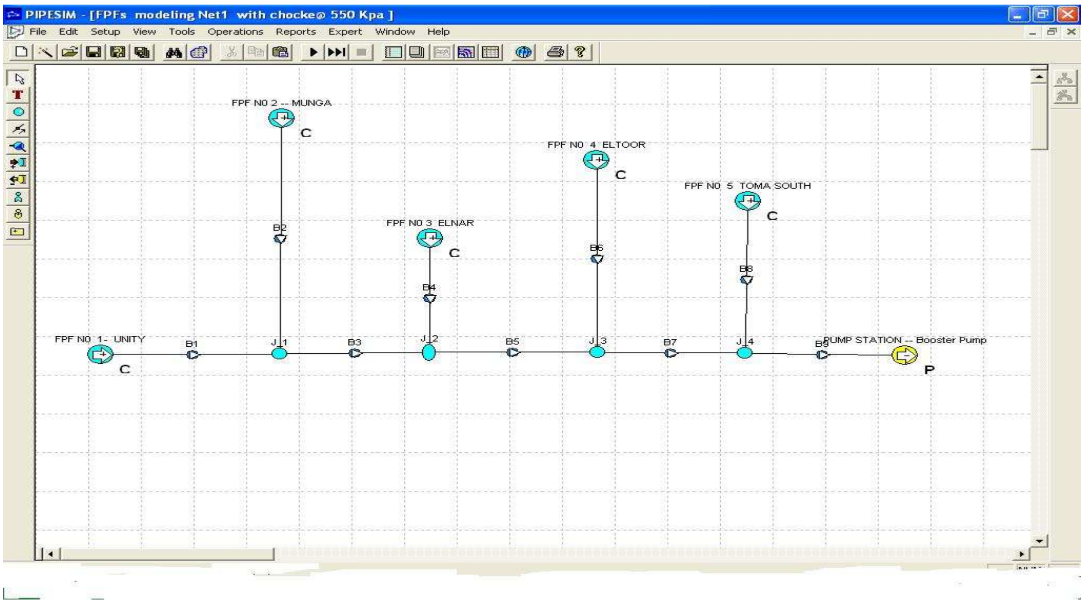
P -Field Processing Facilities Overview (FPF)

Q- Coefficient of general losses

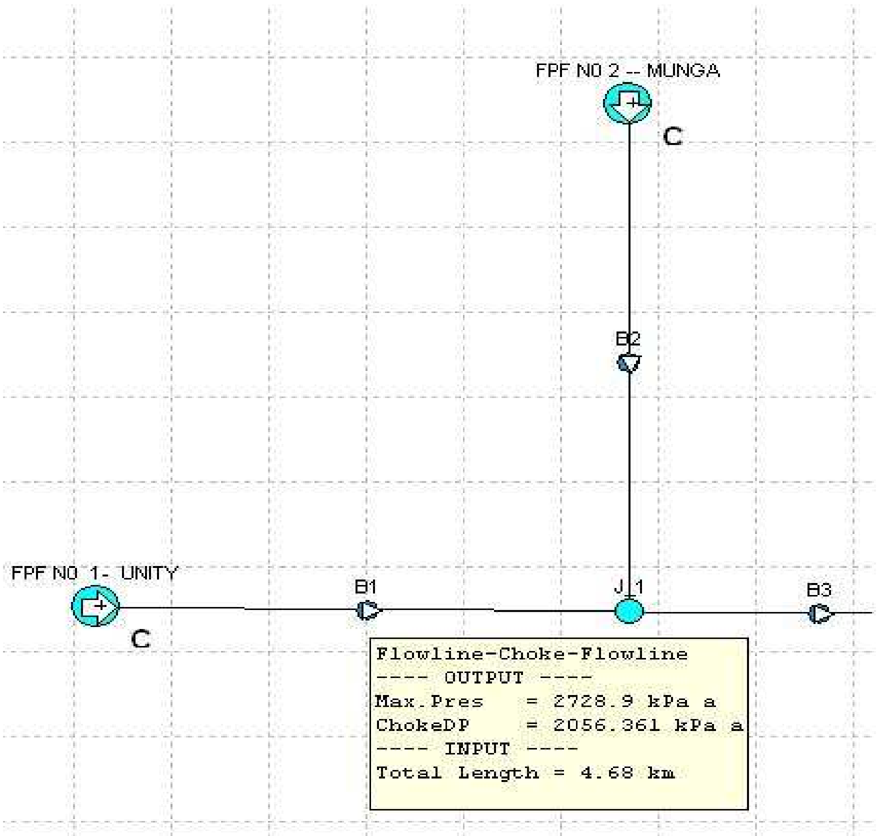
Fitting	Type	KL	Comments
Pipe inlet	t <<< D	0.80	
Pipe exit			Kinetic energy correction factor
		2ά=	Fully developed laminar flow
		1.05 ά=	Fully developed turbulent flow
Bends & branches	90º smooth bend	0.3	Flanged
		0.9	Threaded
	180º return bend	0.2	Flanged
		1.5	Threaded
	90º miter bend	1.1	Without vanes
	90º miter bend	0.2	With vanes
	45 º bend	0.5	threaded elbow
	Tee-line flow	0.2	Flanged
		0.9	Threaded
	Tee-branch flow	1	Flanged
		2	Threaded
	Threaded union	0.08	

Appendix –B – Simulation Results

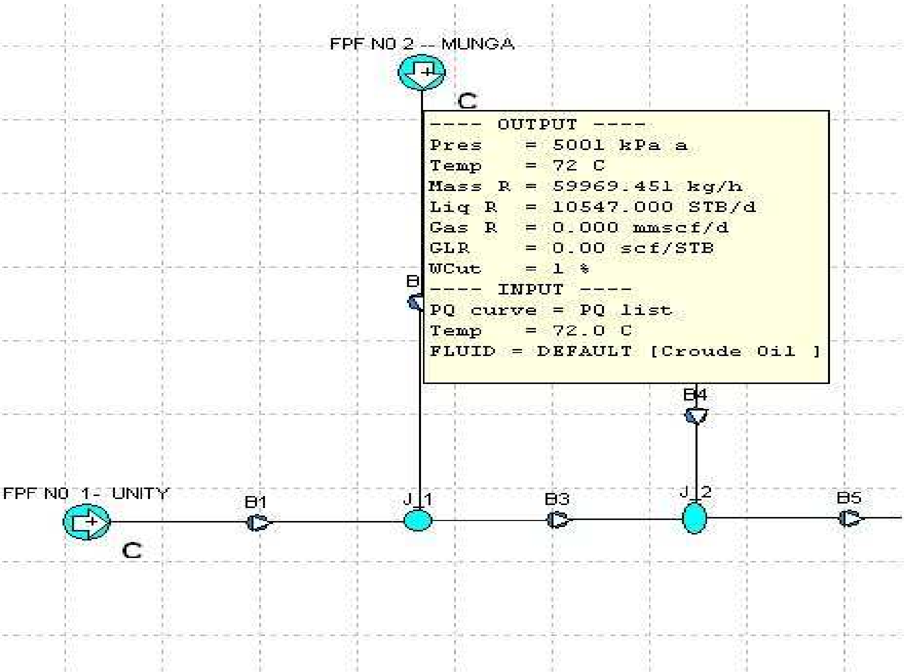
A-Fields Processing Facilities Model



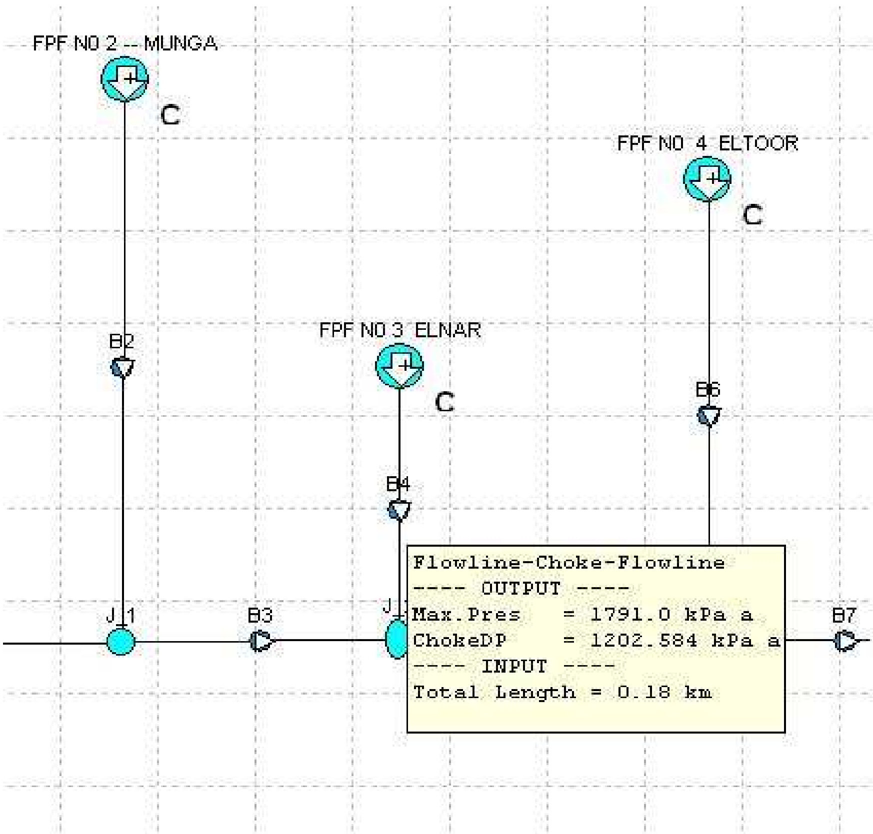
B- UNITY Result @ Suction of Booster Pump 550KPA



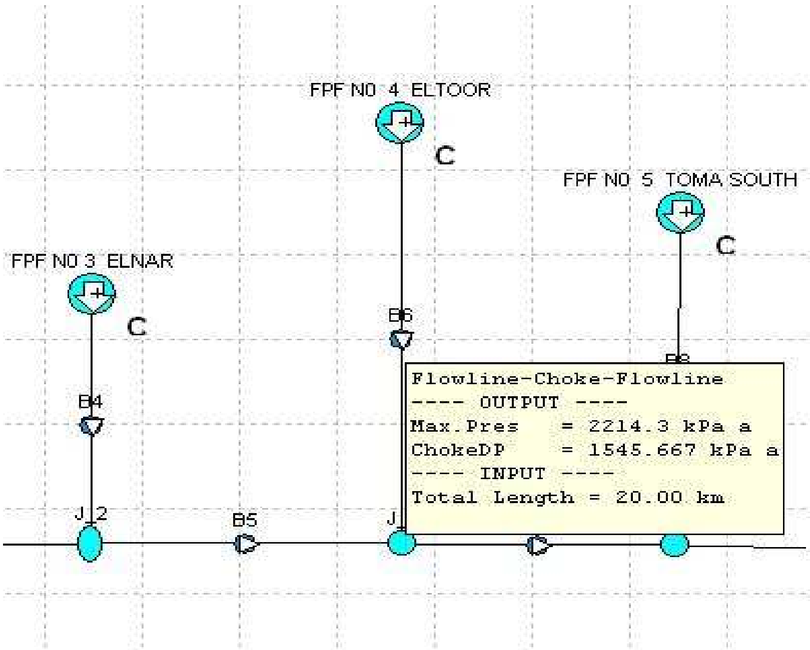
C- MUNGA Result @ Suction of Booster Pump 550KPA



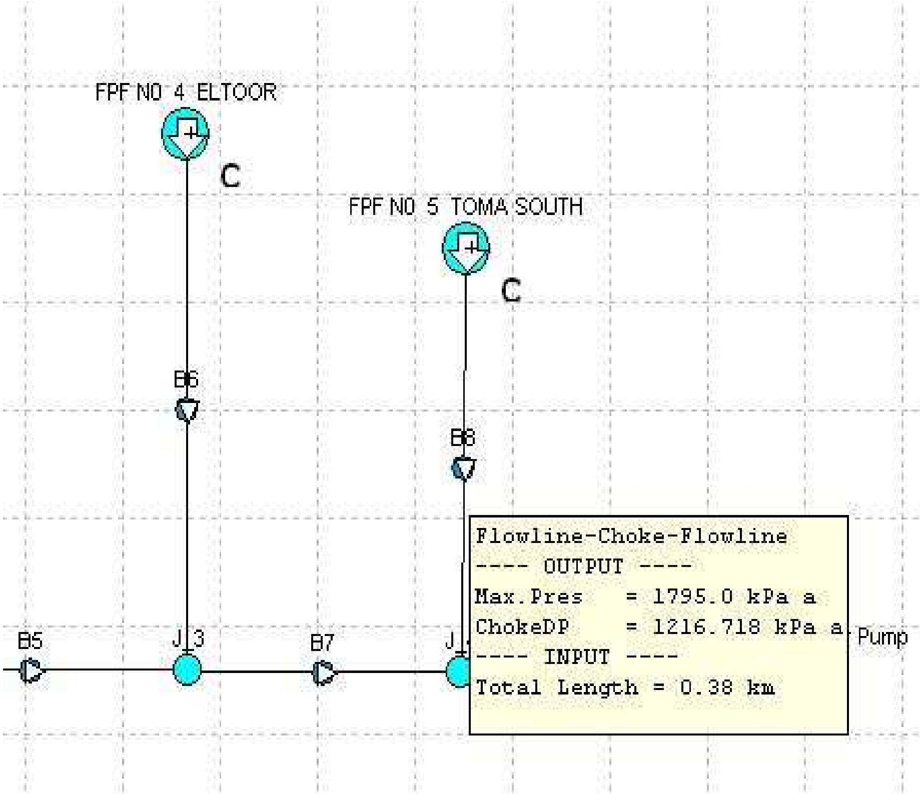
D- ELNAR Result @ Suction of Booster Pump 550KPA



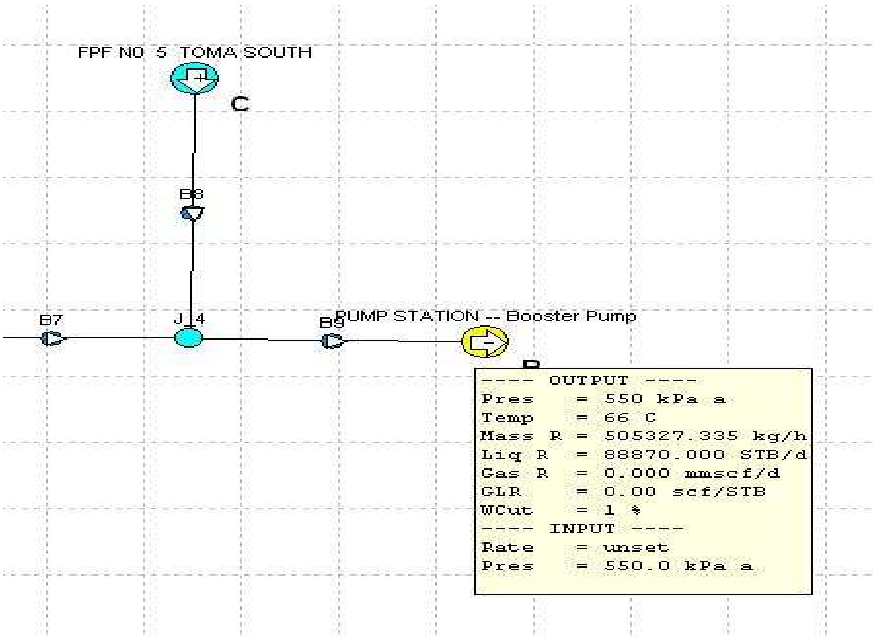
E- ELTOOR Result @ Suction of Booster Pump 550KPA



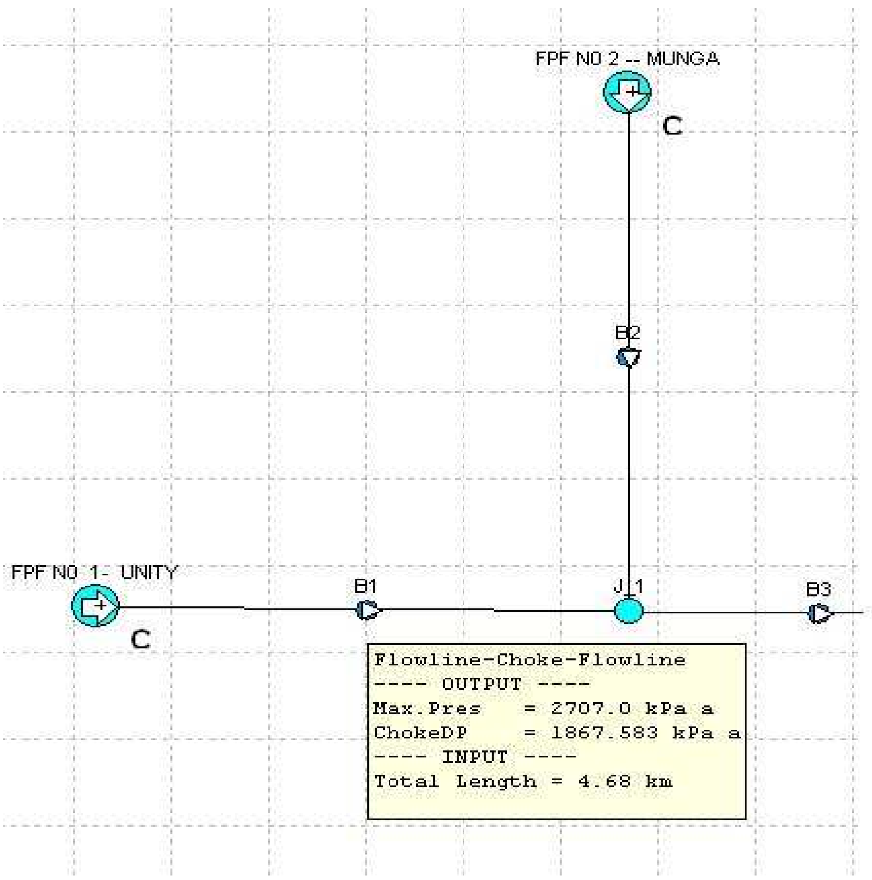
F- TOMA SOUTH Result @ Suction of Booster Pump 550KPA



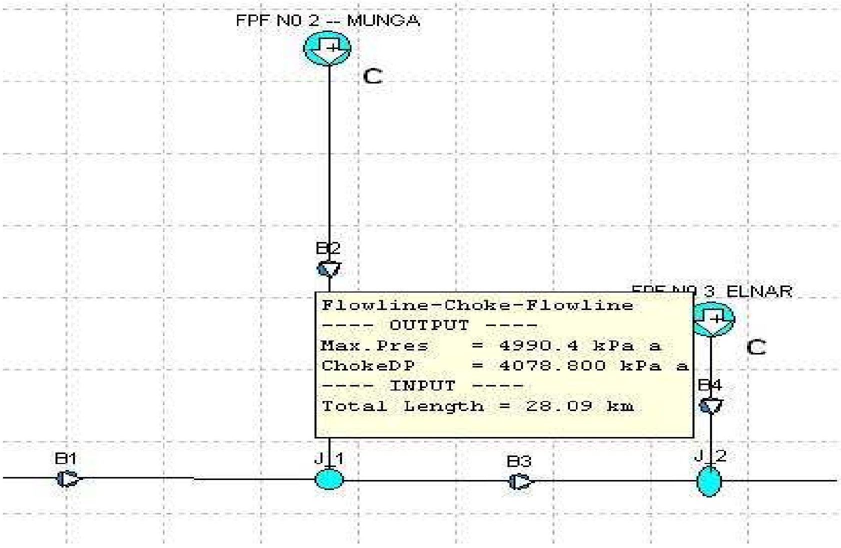
G- Booster pump Result @ Suction of Booster Pump 550KPA



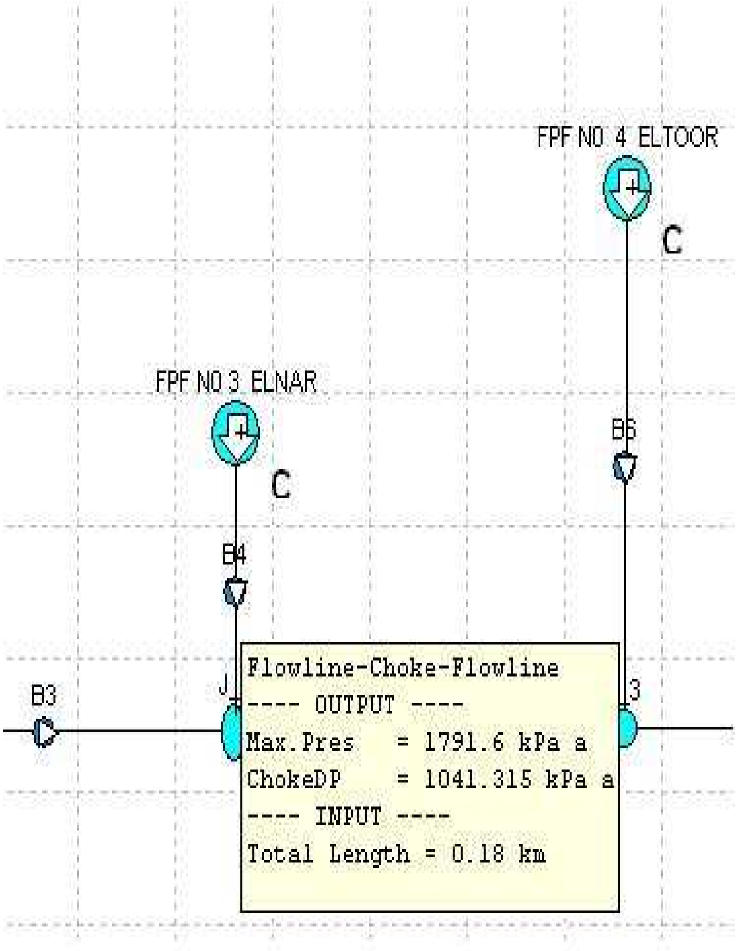
H- UNITY Result @ Suction of Booster 711KPA



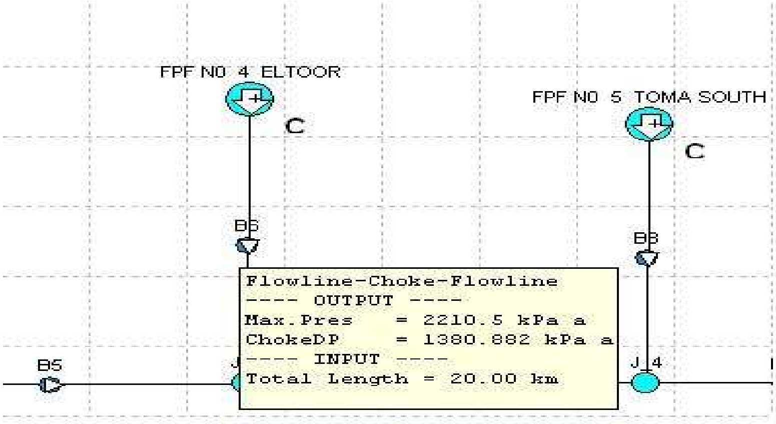
I- MUNGA Result @ Suction of Booster Pump 711KPA



J- ELNAR Result @ Suction of Booster Pump 711KPA

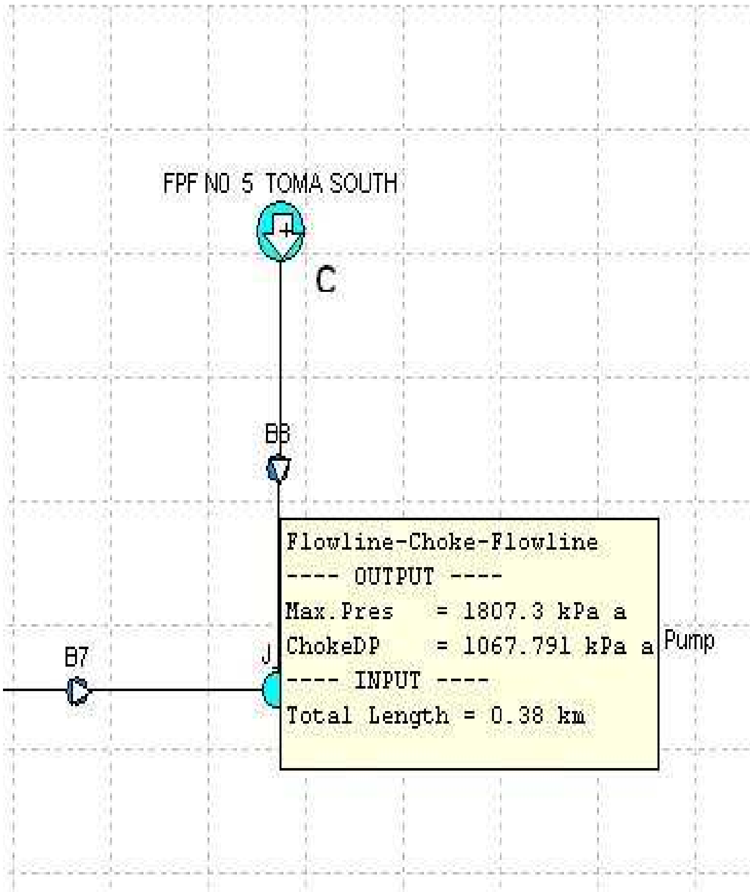


K- ELTOOR Result @ Suction of Booster Pump 711KPA

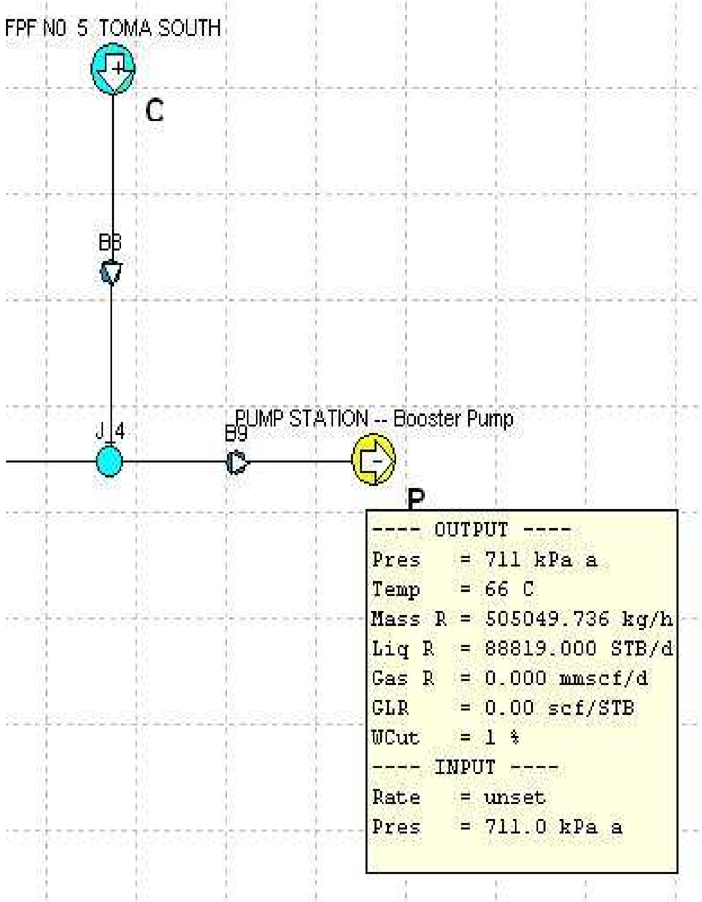


L-

TOMA SOUTH Result @ Suction of Booster Pump 711KPA



M- Booster pump Result @ Suction of Booster Pump 711KPA



Appendix C – Theory

Preface to Crude Oil Processing

The crude oil which is coming from the wells, shown in figure C.1 contains many fluids including gas, condensable vapors, water vapors, crude oil, water and solids .When the fluids reach the surface where the pressure is lower than the reservoir, the capacity of the oil to hold gas in solution decreases and gas separates out of the oil. Also the temperature at the surface is lower than the reservoir temperature therefore well stream vapors will condense and combine with the liquid. Then we need equipments for separation and segregate gas from liquid and one liquid such as crude oil from another liquid such as water [4].

Figure C.1: Crude Oil Production Well [4].

Processing Steps

The crude oil from the field enters the Field Production Facilities by pipes called Oil Gathering Manifold (OGM) shown in figure C.2. Any oil gathering manifold contains some wells from the field to reduce the cost of construction and increasing the pressure of the OGMs at the FPF, The crude oil passing through the heat exchanger to increase the temperature of the crude by heat transfer between the raw crude and crude heated into heaters (heaters theaters) to assist the separation processes by separating the molecular of the materials during heating processes. Then the crude oil after the heating enters the production separators to separate oil from water and gas .There are chemicals injected into crude oil before entering the production separators to separate water from oil such as demulsifies.

The oil goes to heaters for heating .The hot oil used in the heat exchanger as heat medium and then goes to storage tank for storage and is exported by crude oil transfer pumps to Central Processing Facilities (CPF) to separate the remaining water less than 10 % by using the other equipments such as Electrostatic Treaters, Gas boots and Heat Exchanger (sales oil). The water separated from oil at production separators goes to Produce Water Tanks (PWT). There are chemicals injected into the PWT to separate oil which goes with water as emulsion at Produce Water Tanks. The oil which separated from water recovery back to the system and water goes to evaporation ponds, if there is any oil at evaporation ponds its recovery by tankers to recovery system to prevent the environmental pollution after discharging the water into the lands. Also to prevent the environmental pollution there is a biromendation project to use the produced water for special trees in the irrigation, and the produced gas goes to flare stack.

Processing Equipments

The processing of oil requires special equipments such as: Oil Gathering Manifolds, production separators, free water knockout, heat exchangers, heater Treaters, electrostatic dehydration, gas boots, produce water tanks, storage tanks and crude oil transfer pumps.

Production Header (Manifold System)

The manifold system contains lines Oil Gathering Manifold (OGMs) coming from wells. Each line (pipe 10") gathers a number of wells (from 4 to 10). The function of the manifold system or production header to gather all crude oil coming from the field in one header and distributing the crude oil to separators for separation process in three products oil ,water and gas .On the production header there are instrumentation to indicate the pressure at inlet to the field production facilities such as pressure transmitter ,temperature transmitter , Emergency Shutdown Valve (ESDV) to close in cause of emergency and chemical injection point to inject the Emulsifier Reverse to assist in separating water from oil in the production separators [4].

Figure C.2: Production Header - Oil Gathering Manifold.

Production Separators

An oil field production ,or bulk separator shown in figure C.3 is a pressure vessel in which a mixture of non-soluble well fluids are separated from one another .The principles of separation have three necessary physical factors for separation: gravity, fluid insolubility and difference in fluid densities. Separation depends on the effect of gravity to separate the fluids. For efficient separation the fluids must not be soluble in each other. The gas is very much lighter than crude oil. In a separator, gas and oil separate in few seconds and water requires between 40 to 70 seconds to separate from oil.

The main functions of an oil field separator are:

- To cause a primary phase separation of gas from liquid.
- To continue this process by removing entrained liquids from gas.

- To give sufficient time in the separator for gas to be released from oil.
- To allow sufficient time to permit the separation of oil and water.
- To provide controls that prevents gas escaping with the liquids.
- To discharge the separated fluids from the vessel in such a manner that Re-mixing of any of them will be impossible

Three physical factors are necessary for separators to function properly:

- Gravity
- Fluid insolubility.
- Difference in fluid densities

Oil field production separators are classified in two ways, by the way they are installed (vertical or horizontal), and the number of fluids to be separated. The number of phases refers to the number of streams that leave the vessel. For example, an inlet well stream consists of gas, oil and water but in some production separators only the gas and liquid are separated in the vessel. The liquid flows to another separator, where oil and water are separated. A two-phase separator is one in which the inlet stream is separated into two fluid phases. A three-phase separator separates the inlet stream into three product streams of gas, crude oil and water. The following are major types of Separators [4]:
a) Horizontal, two phases or three phase, b) Vertical, two phases or three phase.

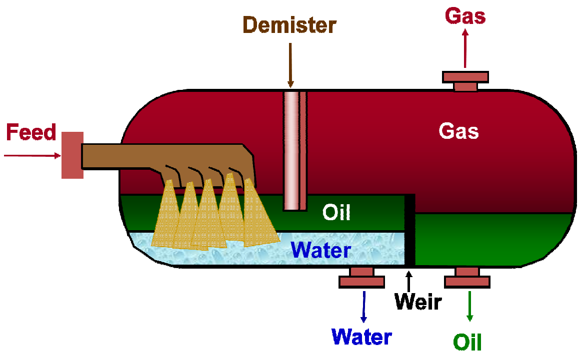


Figure C.3: Three Phase Separator.

Crude Oil Heater Treaters

Heater Treaters Packages are horizontal three phase Separation (gas/liquid/liquid) Heater Treaters. Crude oil enters the Heater Treaters through an 8” inlet nozzle on top of the vessel at an operating temperature of 75ºC.The liquids are turned 90º back into the vessel by a deflection plate. This deflection plate is designed so that the incoming fluids enter the vessel at an optimum position.

In the first section of the Heater Treaters the liquids are heated up by a dual fuel (Diesel/Gas) operated fired Heater. The liquid temperature is increased to 105ºC. When the liquids flow through the heating section the water, oil and gas begin to separate. Immediately after the heating sections the liquids pass under-over flow baffle plate which enhances the liquid-liquid separation. Downstream this baffle the liquid separation in the separator section occurs by gravity with the lighter oil particles rising to the top of the bulk liquid whilst the heavier water particles fall to the bottom.

The Utilities requirements for heater Treaters are:

Power Supply Required: 230 V AC/ 1 Phase / 50 Hz, Maximum Demand: 0.55 KW.

Power Supply Required: 400 V/3 Phase / 50 Hz, Maximum Demand: 58 KW.
The above utility requirements are applicable for each Heater Treaters Package.

Secondarily Separation Stage

The crude oil leaving the Free Water Knockout (FWK0) can still contain up to 10% of emulsified water. In order to remove this, it is passed through the Crude Oil Electrostatic Dehydration shown in figure C.4.

Crude /Crude Heat Exchangers

A heat exchanger is a much used device in the processing industry. With the heat exchanger, all possible liquids and gases can be cooled or heated. This is done by bringing a cold and a warm flow into contact with each other. This cools down the warm flow and simultaneously warms up the cold flow. The cold flow may be a cooling agent, but both flows may also belong to the same process.

There are various types of heat exchangers, such as shell and tube exchangers shown in figure C.5, sheet exchangers, spiral exchangers and lamination exchangers. The designation of the heat exchanger often depends on the purpose of the device in the process installation. A condenser, for example, cools down running gas to a liquid flow, Re-boiler heats up a liquid flow until it boils and becomes gaseous. [4].

The class of shell and tube heat exchanger can be further divided into different types. Beside the various types of heat exchangers, the TEMA (Tubular Exchanger Manufacturers Association) uses three quality classes for mechanical designs (Class A, Class B and Class C). The class required, depends on the circumstances under which the heat exchanger must function.

In the movement of liquids there are two kinds of flow; laminar flow and turbulent flow .Also there are two types of flow in heat exchangers or a combination of both (Co- current and Counter current).

The function of heat exchangers in crude oil field to heat up the crude oil coming from the wells to assist the separation process and maintaining the viscosity of the oil to reduce the wax formation and to make the flow of the fluid in the pipes very easy .The rate at which heat is transferred between hot crude and cold crude depends on these main factors: temperature difference, surface area, transfer coefficient and velocity of flow [4].

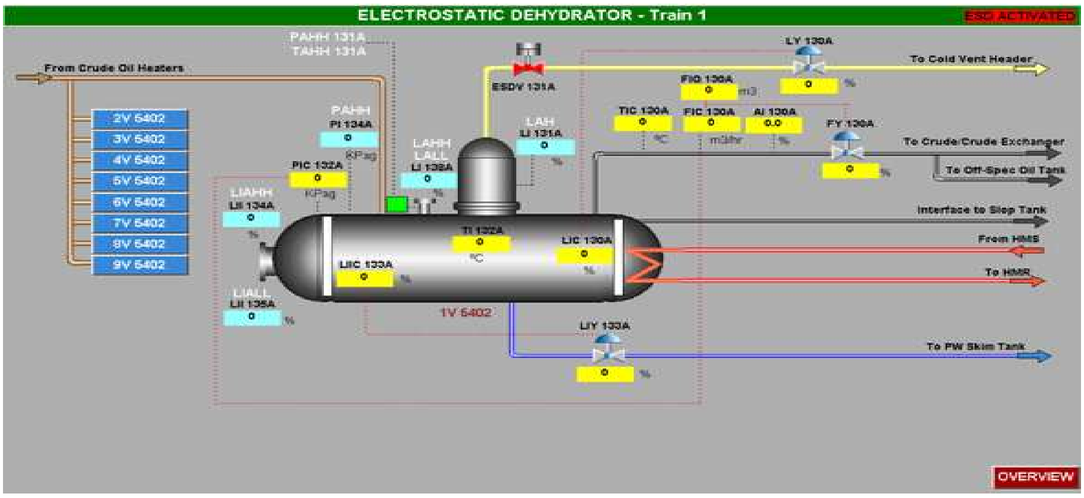


Figure C.4: Electrostatic Dehydrator.

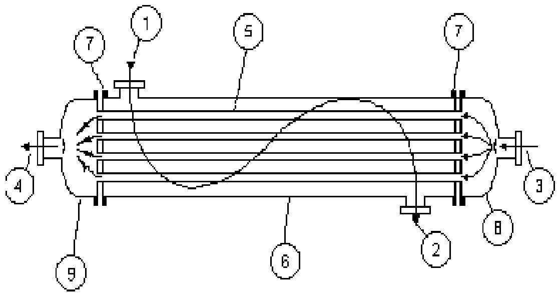


Figure C.5: Shell and Tube Heat Exchanger.

1-Hot fluid to be cooled

2-Cooled fluid

3- Cold fluid to be heated

4- Heated fluid

5- Tube

6- Shell

7- Tube sheet

8 – Distributor

9 – Cover

Chemical Injection

The chemical injection is the hand operation and will be placed on a chemical skid to pump into the inlet point using a Milton Roy Diaphragm pump, if the wax accumulation is too heavy it is necessary to inject a pour point depressant into the flow lines to prevent the formation of wax. In this case we need hot oil circulation to ensure the temperature of waxy crude does not fall below its pour point temperature that would allow solidification or accumulation of waxy deposits.

Another chemicals have been injected at the inlet of production separation such as Demulsifies Reverse to assist in separation of water from oil .And Reverse Demulsifies its inject in the produce water before the water entering the Produce Water Tanks (PWT) to separate oil from water to make oil recovery to the system and to prevent environmental pollution when the water going to evaporation ponds. The different types of chemicals used in petroleum industry are shown in figure C.6.

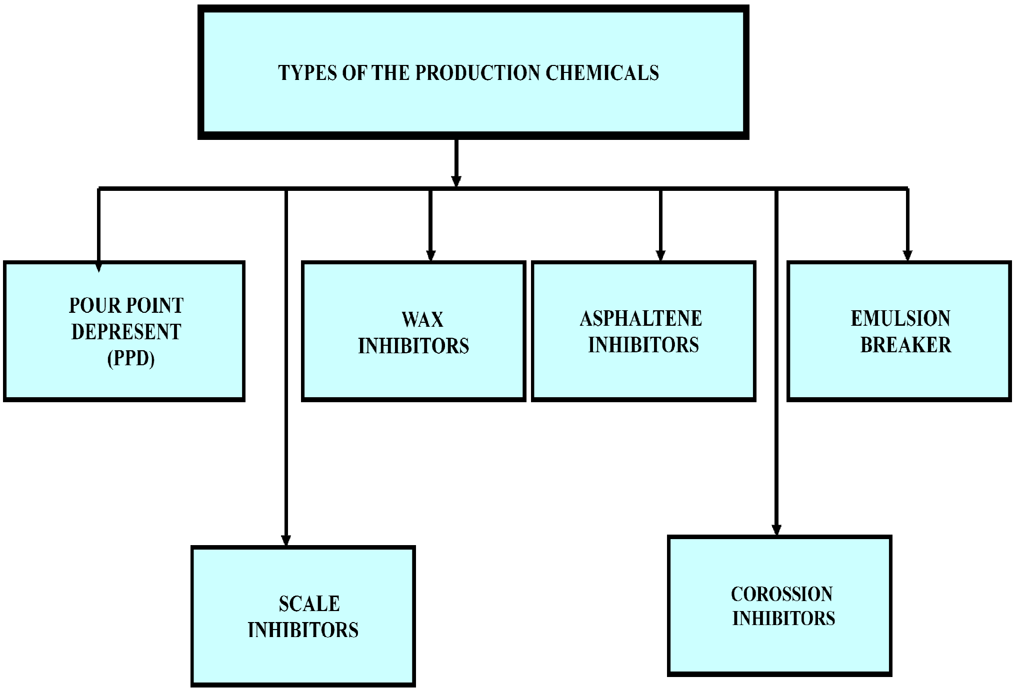


Figure C.6: Chart of Chemicals Types.

Oil processing Utilities Systems

The utilities system is very important for operation in the field production facilities, it's needed for a successful operation of most manufacturing processes and it is essential for certain variables generally referred to as process variables.

The principle parameters of the process Instrumentation are those concerned with the measurement and control of process such as the flow, pressure, level and temperature .The utilities in the field production facilities are compressor air system, diesel system, heat medium system, flare system, electrical power distribution, drain system and potable water system [4].

Air Compressor & Instrument air system

The function of air compressor is to produce compressible air from atmospheric air after filtration process. The produced air goes to utility air Receiver for storage, it has a net storage capacity of 4.5 m3 and operates at 1350 KPA (g) pressure. The utility air is distributed from the receiver to the various utility air systems .There are two air distribution systems, utility air and instrument air system. The utility air system is used for many purposes such as air tools, air operated pumps equipment, cleaning and purging.

The instrument air system it is very important for the filed production facilities to control the operation system to operate the emergency shutdown valve in normal operation and emergency cases. It also operate the pressure control valve (PCV) and pressure safety valve (PSV) to release access pressure above the operation pressure .For the usage of this the instrument air supply must be dry (no moisture) and filtered (no solids) as the presence of either will affect control valve operation and cause internal damage .

Diesel System

The Diesel Fuel System in the Field Production Facilities (FPF) is designed to supply Diesel Fuel to the Power Generators, Firewater Pumps, Heating Medium Heaters, and Diesel /Water Injection System. A similar system is installed at each FPF but at most stations it is only used for the standby generator [4].

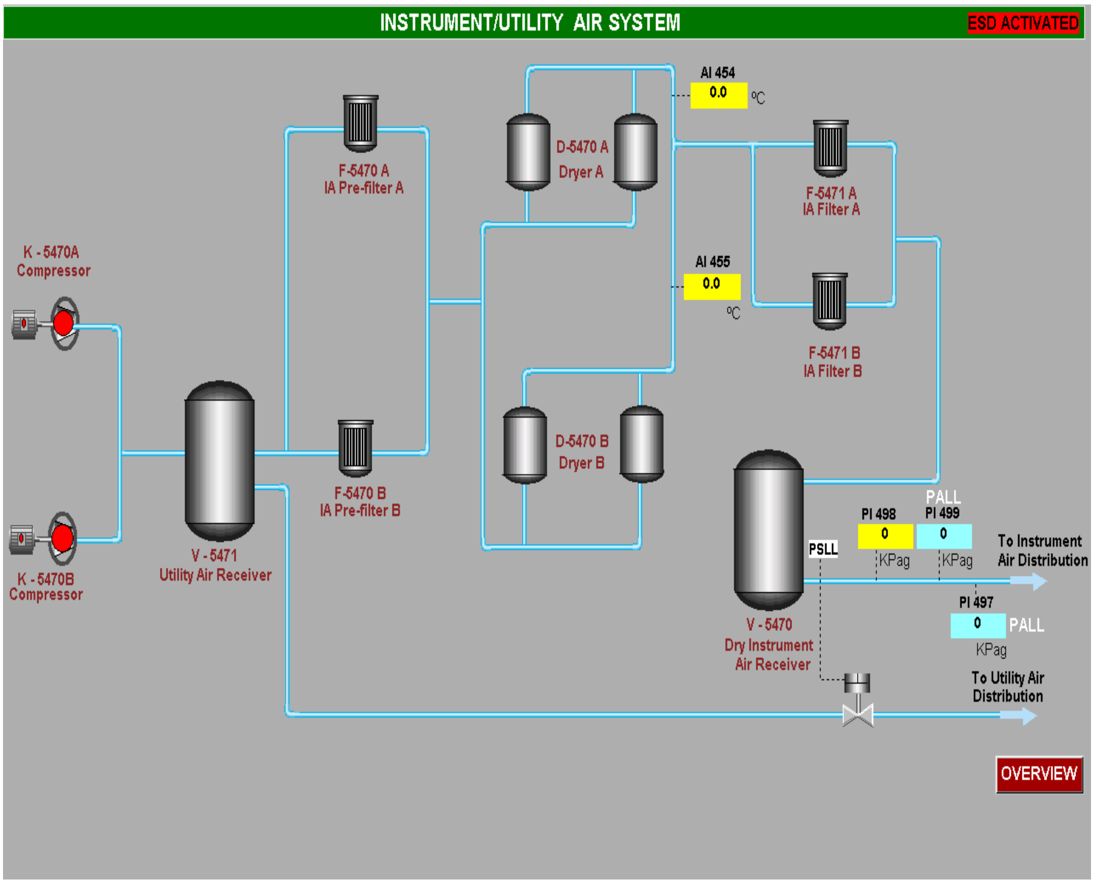


Figure C.7: Air compressors & Instrument air system.

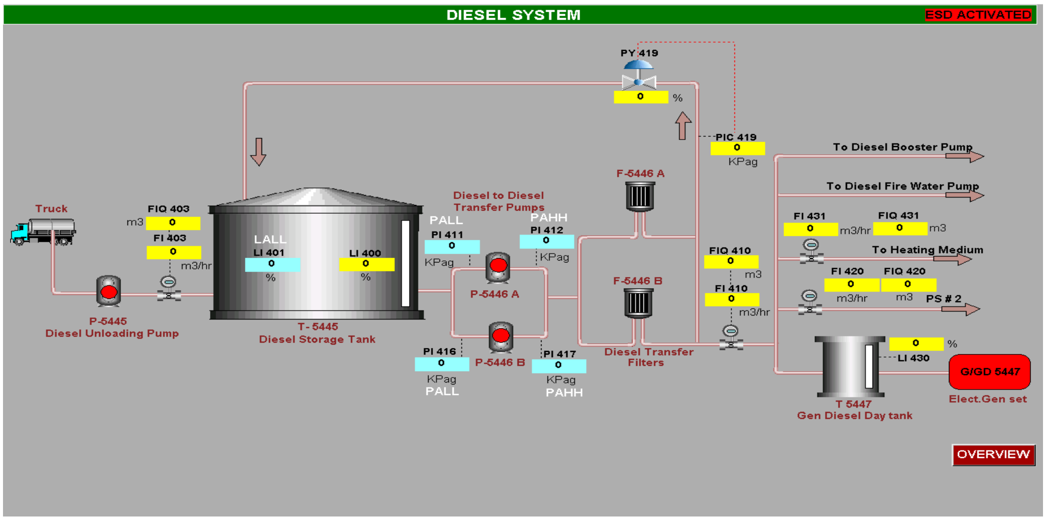


Figure C.8: Diesel System Distribution.

Drain System

The Drain System has been provided to collect fluids from equipment overflows, open drainage and tank bottoms. Also, it will benefit is enabling the recovery of oil from contaminated liquids, and thus safeguard the environment.

A drain pit is the most common type used in the field processing facilities FPF's, but on the larger FPF plants some drain sumps are sunk into the ground. These sumps are fitted with pumps that will return the fluids to the plant for reprocessing. A portable pump is used to pump out the drain pit as required [4].

- The drain systems shown in figure C.9 are designed to collect fluids from process equipment, i.e., when draining equipment prior to maintenance, drainage during sample taking, etc.

  The drain system handles the following:-
- Uncontaminated fluids, crude oil and diesel (closed drains).
- Fluid contaminated with rain or wash water (open drain system)
- Fluids from PSVs of all the vessels (Pressure relief system).

Flare System

- Gas from the Separators vessels, test separator, electrostatic Treaters and gas boots joined in one header that is routed to the flare knock drum to accumulate oil droplets which go with gas.
- The gas line to flare stack fitted with flare arrestor to prevent the possibility of a flame travelling back along the line which could cause an explosion in the Flare Knock Out (FKO) vessel is shown in figure C.10.

Crude Oil Storage Tanks

Crude Oil Storage Tanks (COST) are used to store liquids shown in figure C.11. There are different kinds of tanks that are used to store different liquids. The crude oil can be stored in plain covered tanks .Some liquids must be stored in pressure tanks and very light and highly volatile liquids must be stored in sealed tanks to prevent evaporation.

Storage tanks are normally used at the ends of a process system in the production facilities and used in the beginning to hold the crude products supplied to the plants for processing such as refinery, there are heaters used to keep the liquid thin enough to be pumped and water settling at the tank bottom to drain out the tank .fluid such as oil and water are stored in two types of vertical tanks coned roof and floating roof tanks [4]

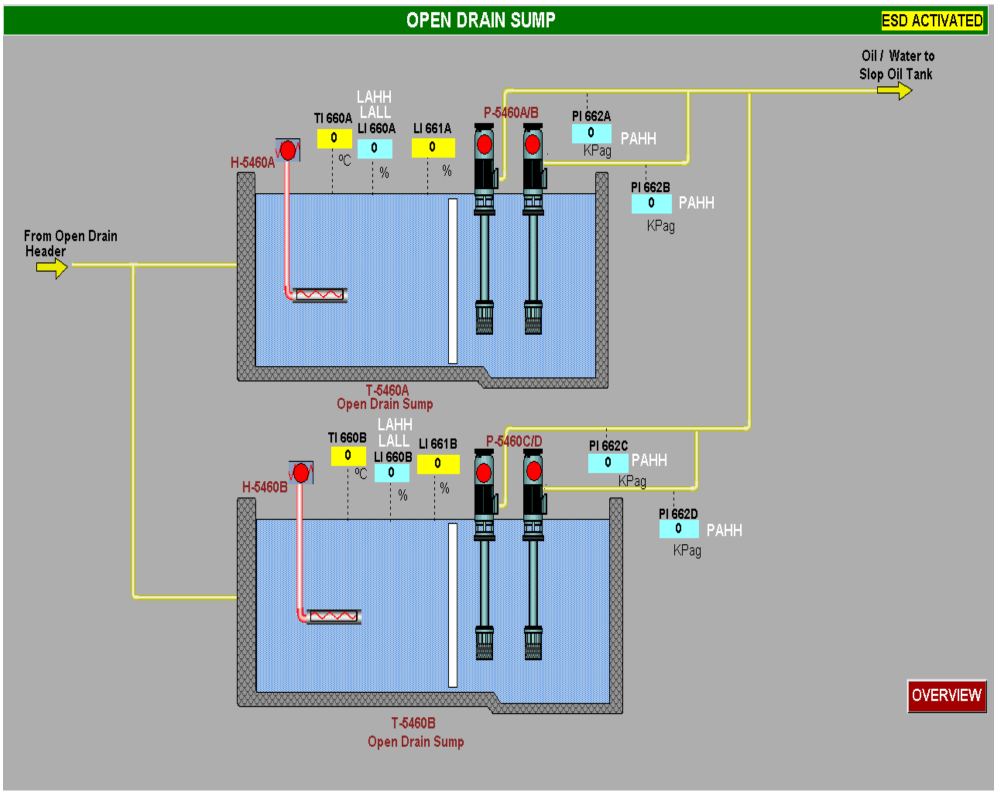


Figure C.9: Drain System.

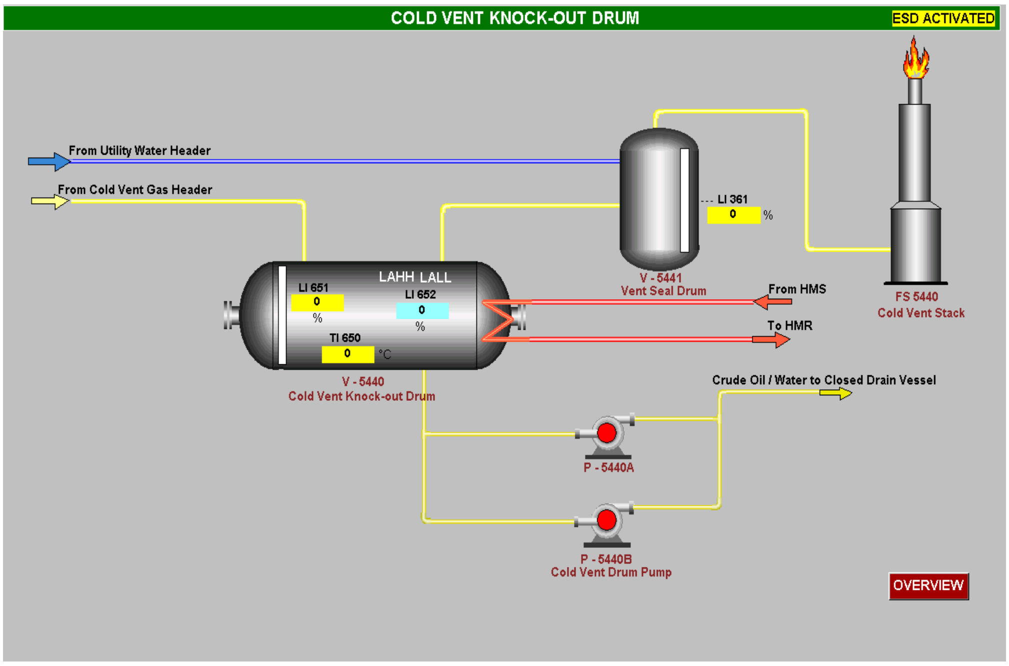


Figure C.10**:** Flare Knock out "FKO" System.

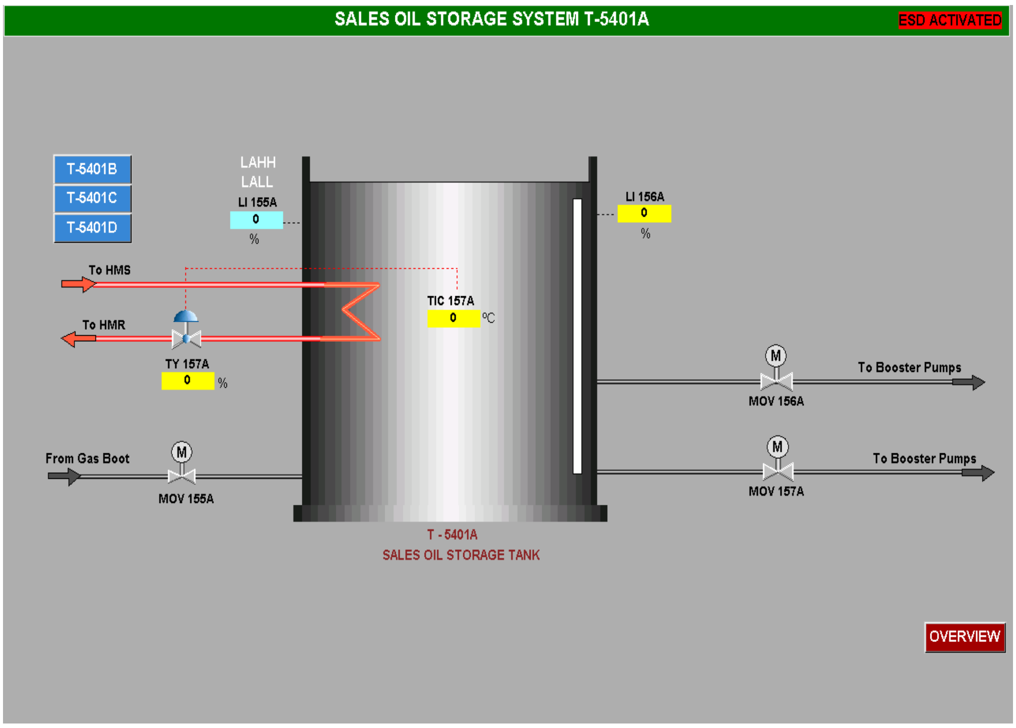


Figure C.11: Crude Oil Storage Tank.