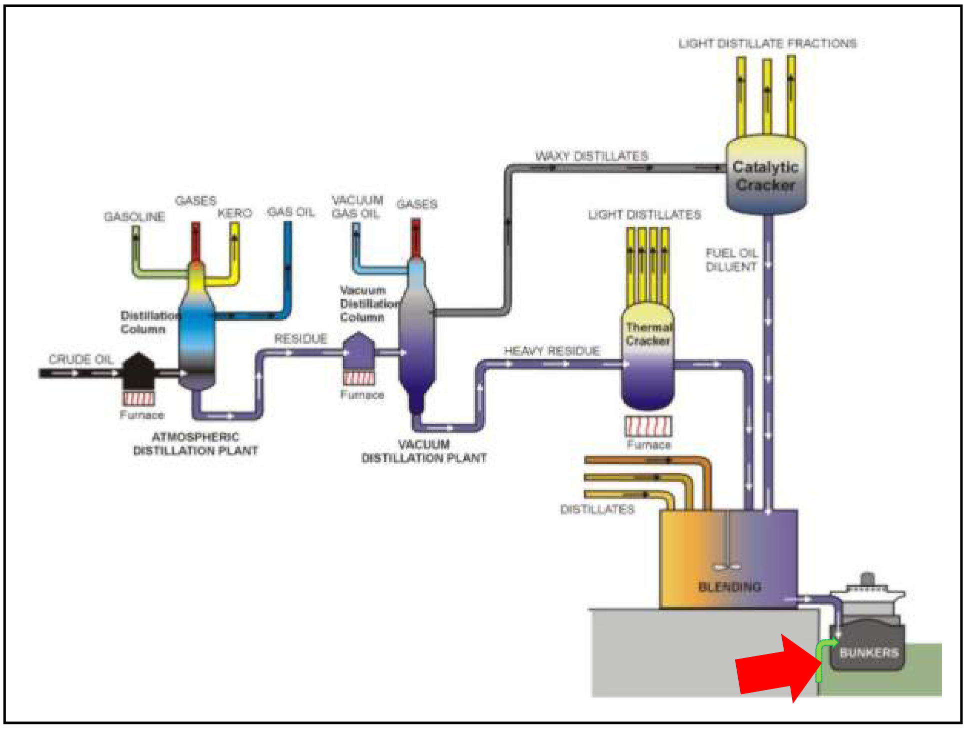
ΒΟΗΘΗΤΙΚΑ ΜΗΧΑΝΗΜΑΤΑ ΠΛΟΙΟΥ ΙΙΙ

ΣΥΣΤΗΜΑΤΑ ΕΚΦΟΡΤΩΣΗΣ

Part I

Φυγοκεντρικοί Διαχωριστές



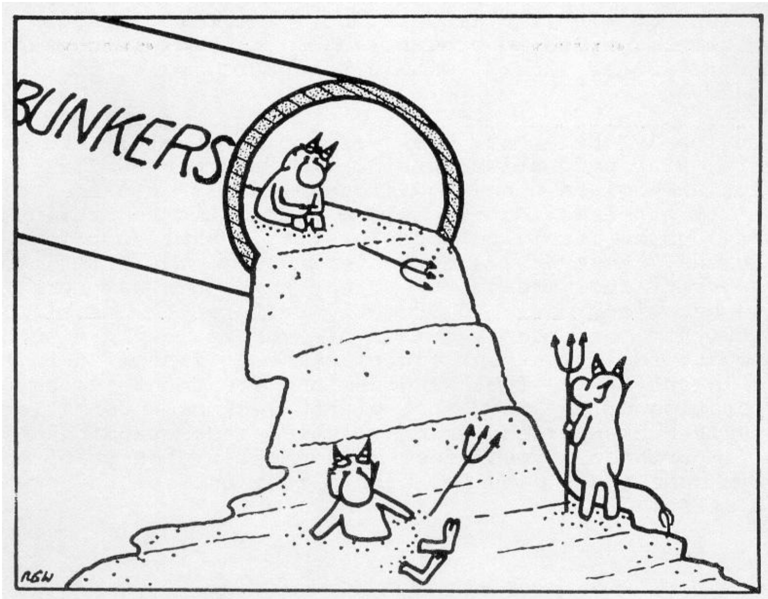
ΣΥΓΚΡΙΣΗ ΧΑΡΑΚΤΗΡΙΣΤΙΚΩΝ ΚΑΥΣΙΜΩΝ
ΠΡΩΤΟΓΕΝΟΥΣ ΔΙΥΛΙΣΤΗΡΙΟΥ & ΔΙΥΛΙΣΤΗΡΙΟΥ ΣΧΑΣΗΣ

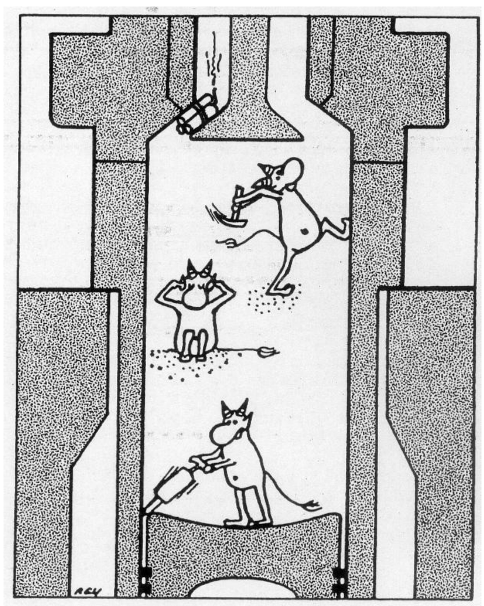
ΠΡΩΤΟΓΕΝΕΣ

- **Χαμηλή Πυκνότητα**
- **Χαμηλότερο Ιξώδες**
- **Λιγότερο Θείο**
- **Υψηλό Σημείο Ροής**
- **Λιγότερο Εξανθράκωμα**
- **Λιγότερα Ασφαλτένια**

ΣΧΑΣΗ

- **Υψηλή Πυκνότητα**
- **Μεγαλύτερο Ιξώδες**
- **Περισσότερο Θείο**
- **Κανονικό Σημείο Ροής**
- **Περισσότερο Εξανθράκωμα**
- **Αυξημένα Ασφαλτένια**
- **Υπολείμματα Καταλύτη** ***(Αλουμινίου & Πυριτίου)***
- **Περισσότερο Βανάδιο**
- **Συμβατότητα** ***(Προβλήματα Διαχωρισμού)***


BUNKERS



- Το 34% των αναφερομένων προβλημάτων φθοράς χιτωνίων συσχετίζονται με το **αλουμίνιο** (ήταν πάνω από 30 ppm)

- Τα μέταλλα **Βανάδιο** και **Νάτριο** σε αναλογία **3:1** προσβάλουν ορισμένα εξαρτήματα, όπως τις βαλβίδες εξαγωγής όπου η θερμοκρασία κατά καιρούς υπερβαίνει το σημείο τήξης των δύο μετάλλων (τα μίγματα αυτά επικάθονται στις κεφαλές των εμβόλων προκαλόντας διάβρωση και μείωση της εναλλαγής της θερμότητας).

Η ΕΠΙΔΡΑΣΗ ΤΩΝ ΔΙΑΧΩΡΙΣΤΩΝ ΣΤΑ ΧΑΡΑΚΤΗΡΙΣΤΙΚΑ ΤΟΥ ΚΑΥΣΙΜΟΥ

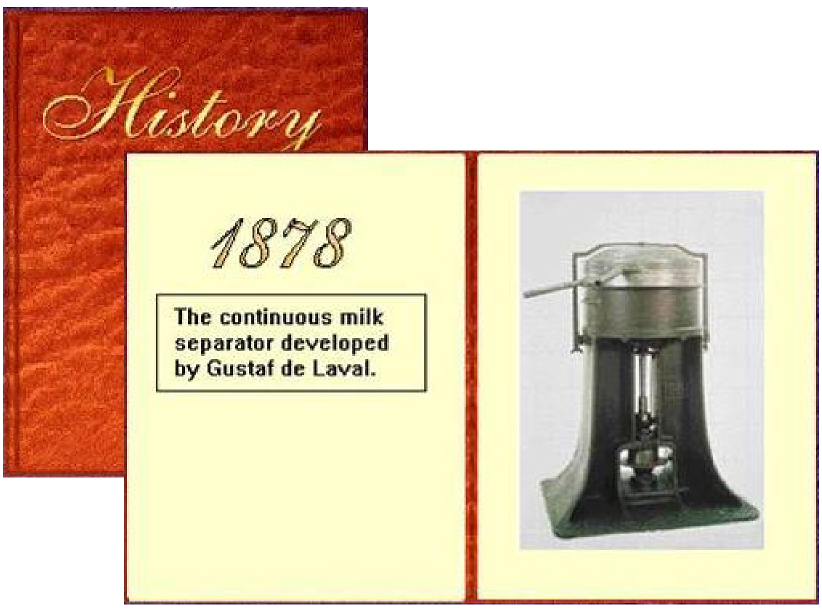
ΜΕΙΩΝΟΝΤΑΙ ΕΛΑΦΡΩΣ

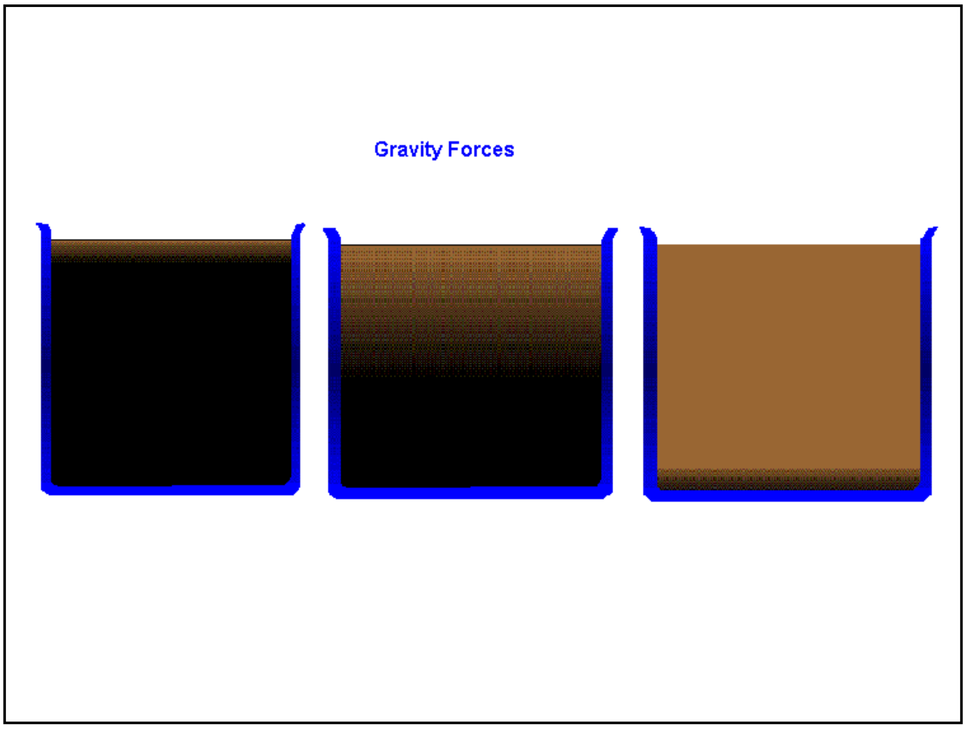
- **Το ΣΥΝΟΛΙΚΟ ΙΖΗΜΑ**
- **Η ΤΕΦΡΑ**
- **Το ΑΣΒΕΣΤΙΟ**

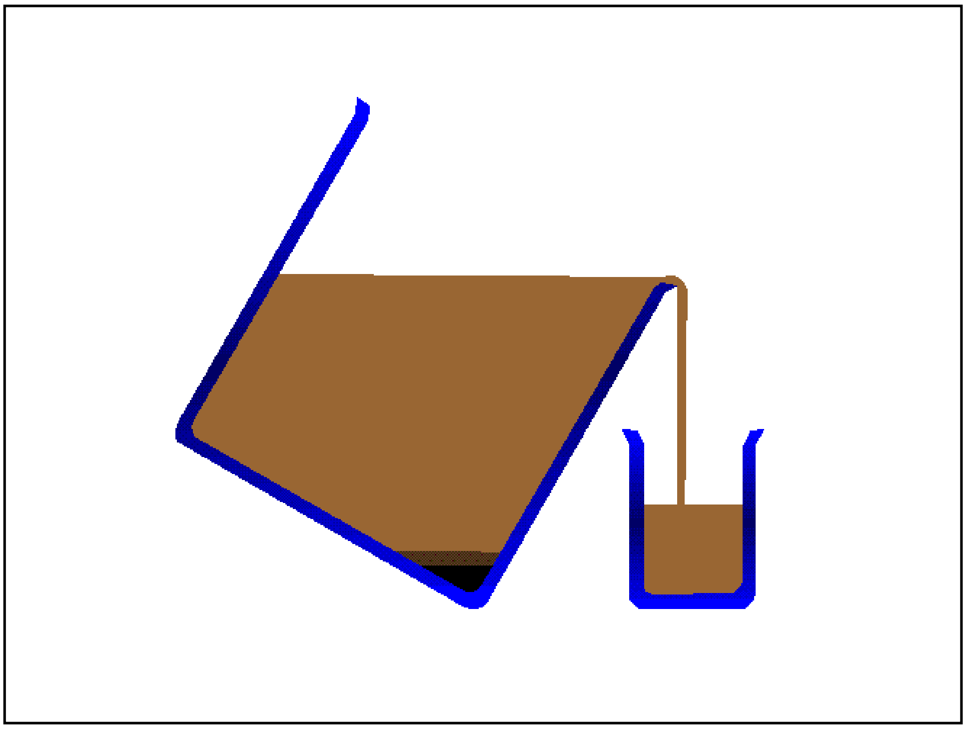
Η ΕΠΙΔΡΑΣΗ ΤΩΝ ΔΙΑΧΩΡΙΣΤΩΝ ΣΤΑ ΧΑΡΑΚΤΗΡΙΣΤΙΚΑ ΤΟΥ ΚΑΥΣΙΜΟΥ

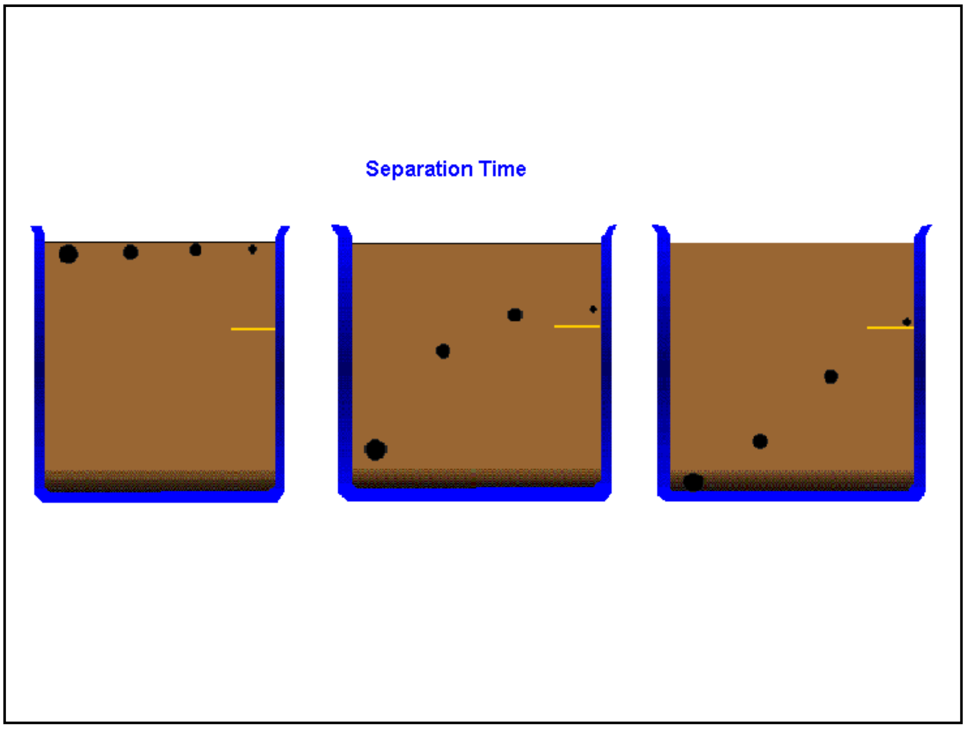
ΑΦΑΙΡΟΥΝΤΑΙ

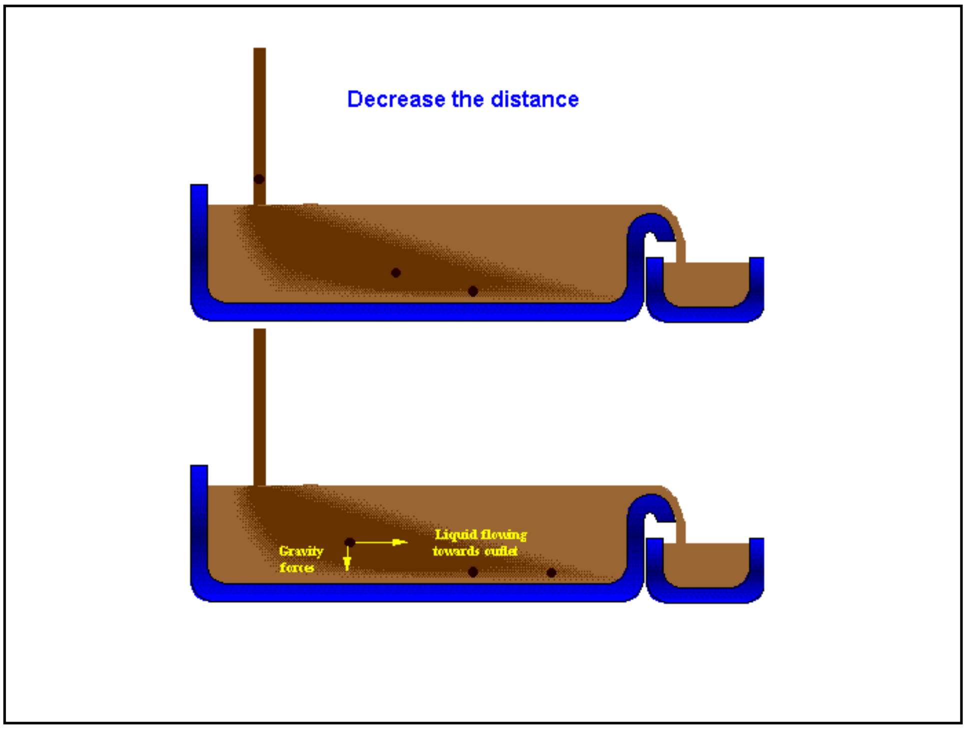
- **Το ΝΕΡΟ**
- **Το Μέταλλο ΝΑΤΡΙΟ**
- **Τα Υπολείμματα του Καταλύτη**
  ΑΛΟΥΜΙΝΙΟ
  ΠΥΡΙΤΙΟ
- **Τα Μέταλλα**
  ΣΙΔΗΡΟΣ
  ΜΑΓΝΗΣΙΟ

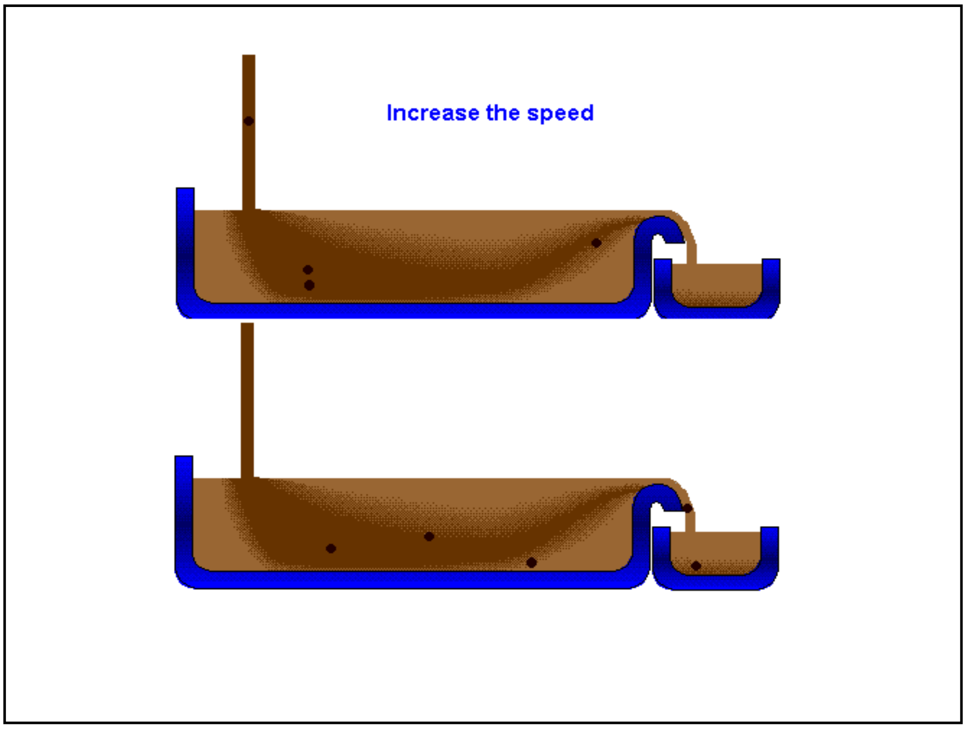


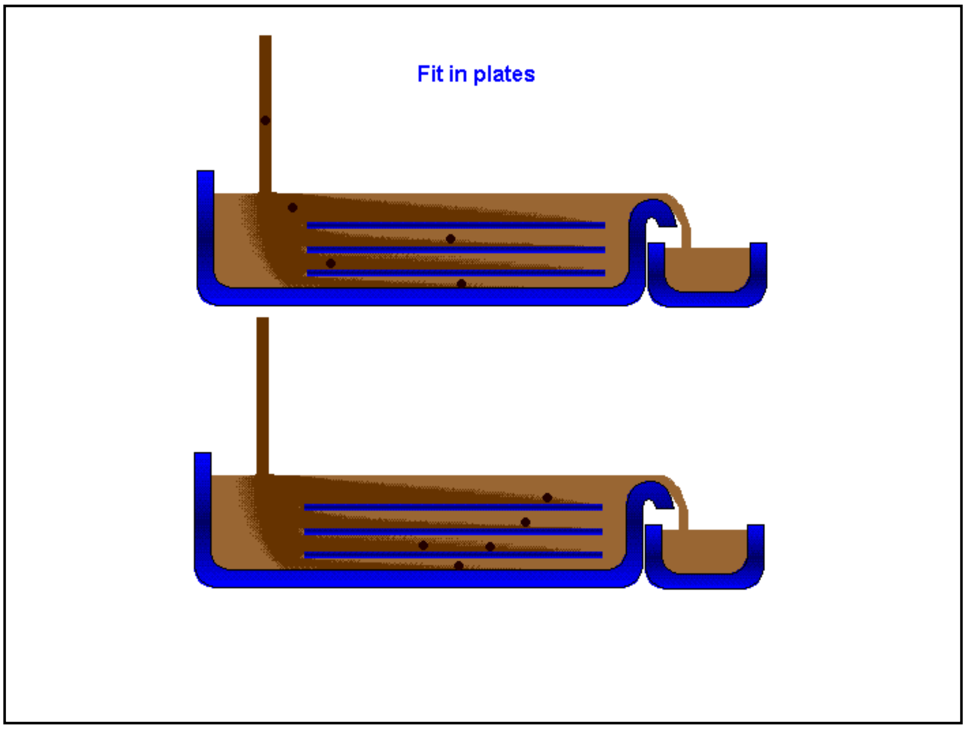

Gravity Forces



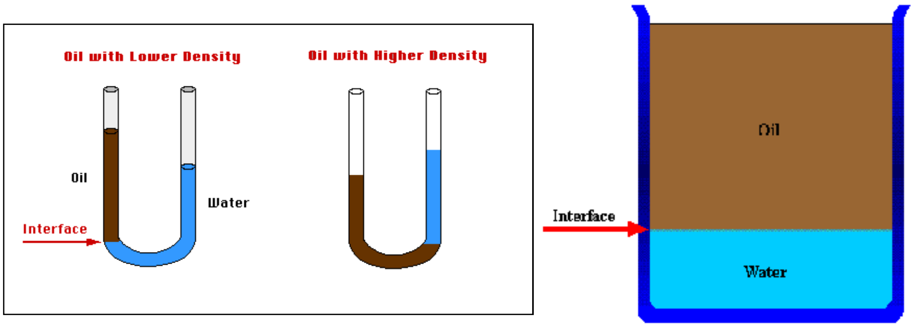

Separation Time

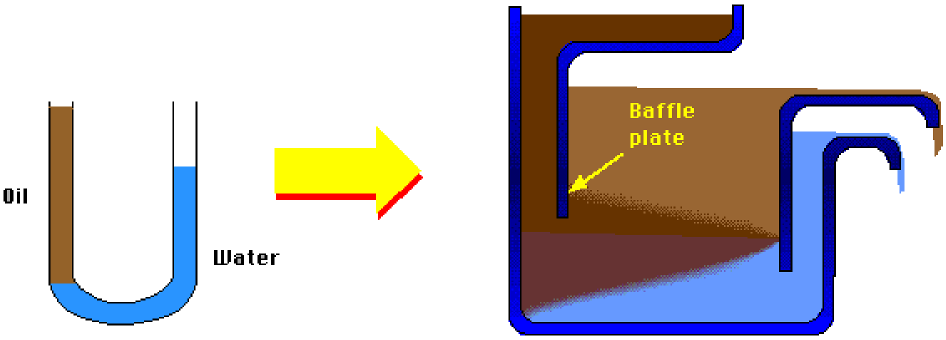

Decrease the distance
Gravity forces
Liquid flowing towards outlet

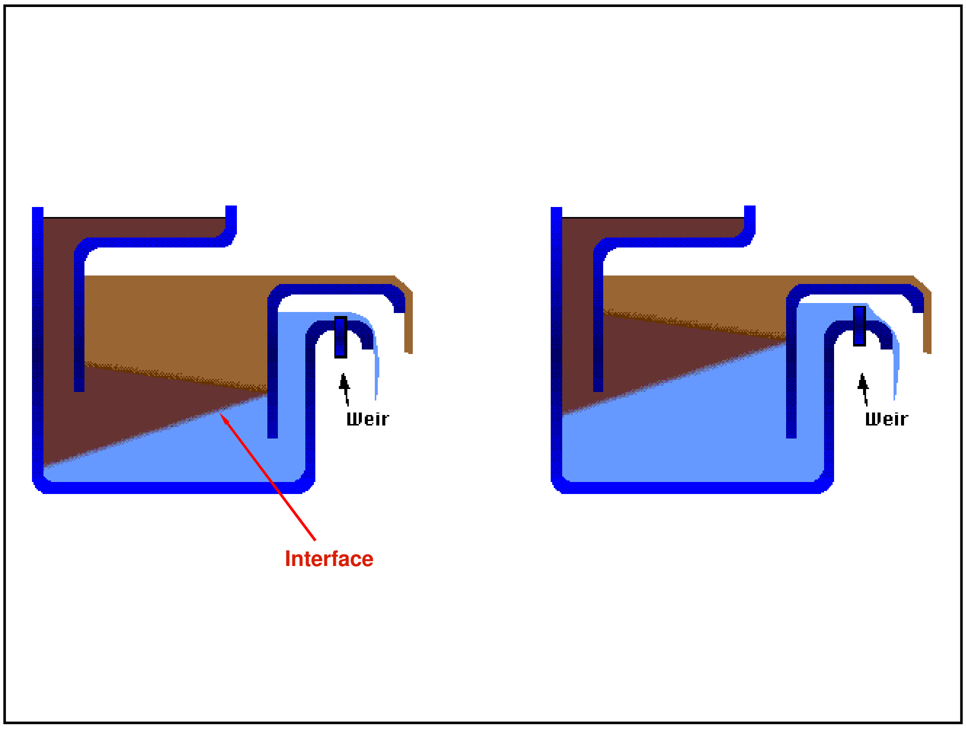

Increase the speed

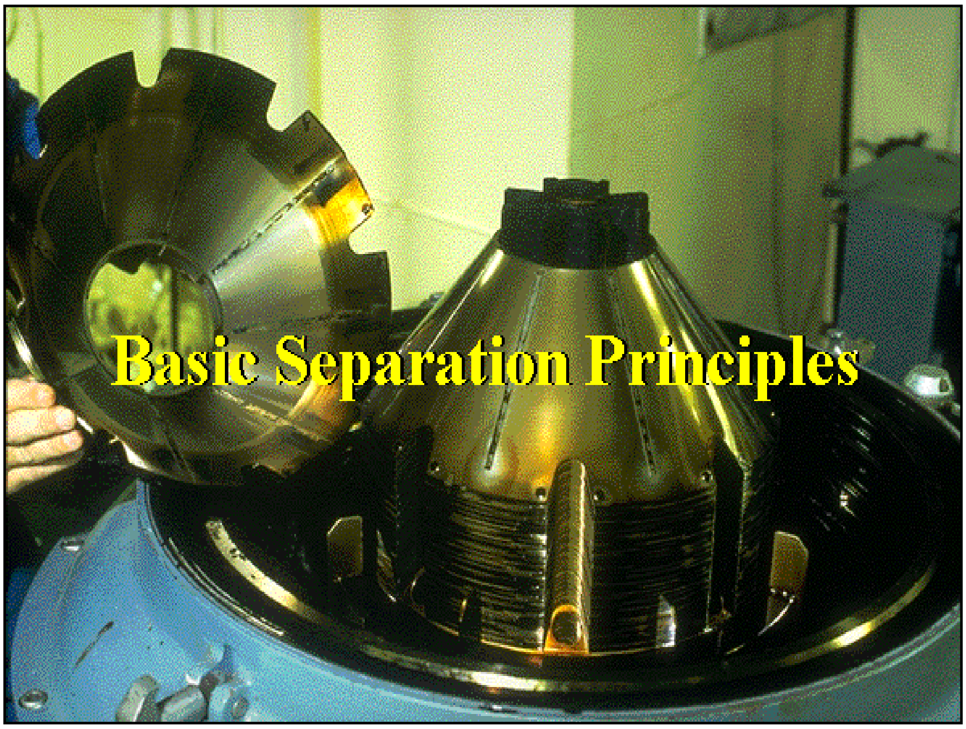

Fit in plates

Liquid Layers





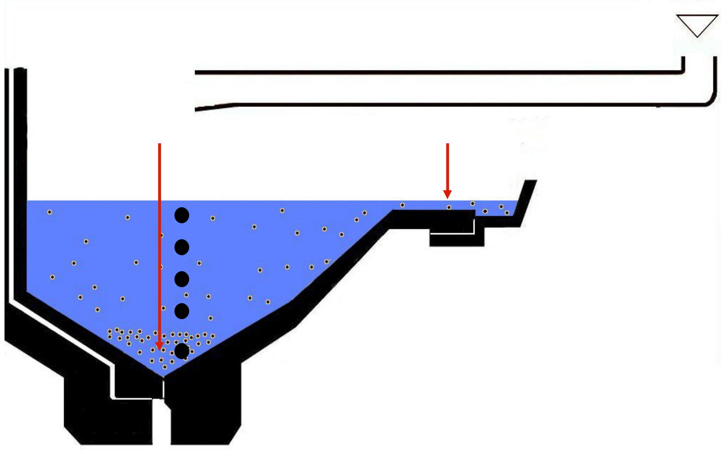

Weir
Weir
Interface


Basic Separation Principles

BASIC SEPARATION THEORY

Conventional separator = A tank

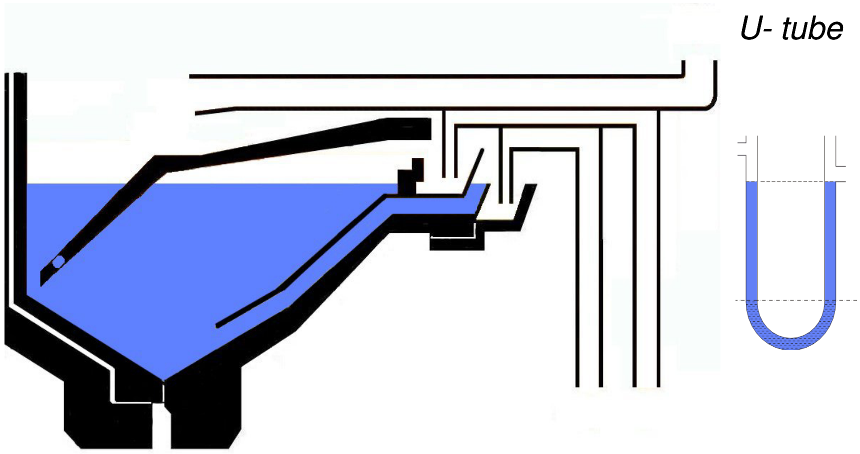
- ***With liquid & solids***



BASIC SEPARATION THEORY

Conventional separator = A tank

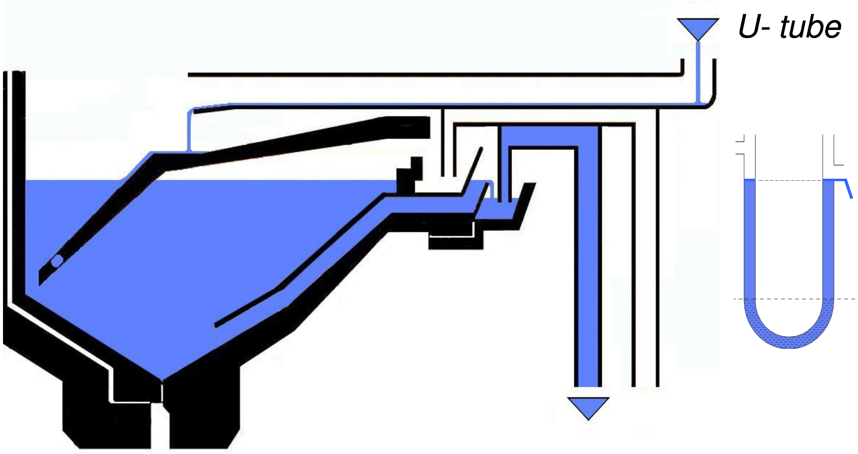
- ***Water seal filled***



BASIC SEPARATION THEORY

Conventional separator = A tank

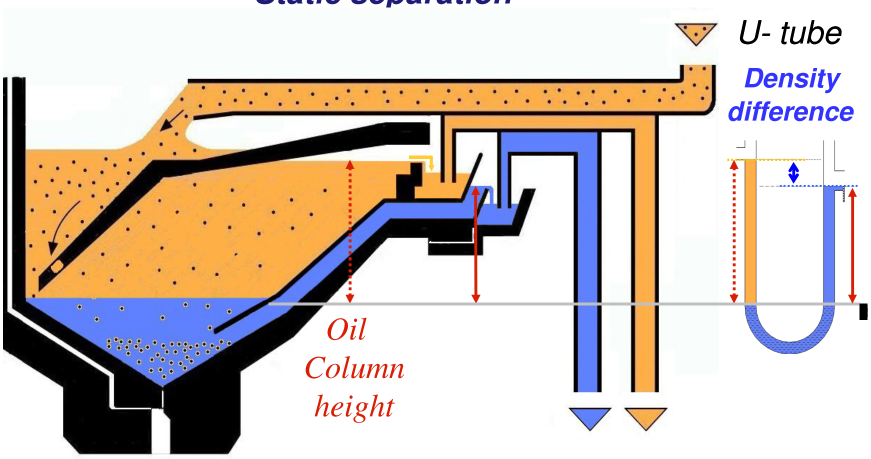
- ***Additional Water seal***



BASIC SEPARATION THEORY

Conventional separator = A tank

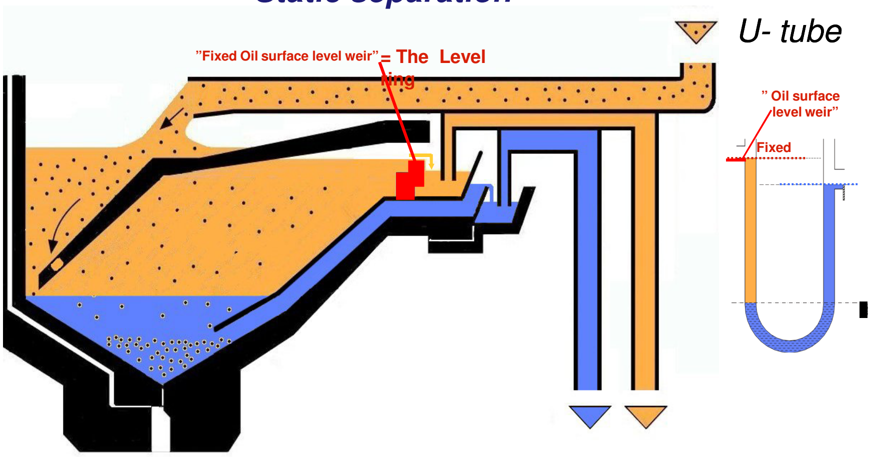
- ***Static separation***



BASIC SEPARATION THEORY

Conventional separator = A tank

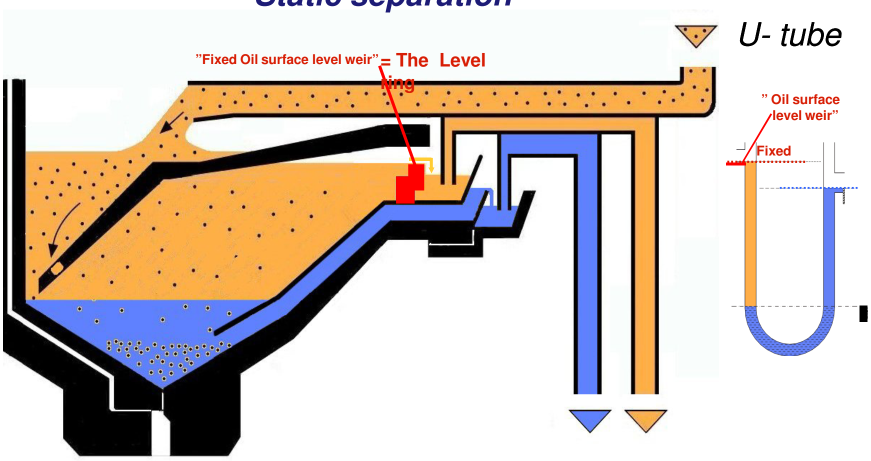
- *Static separation*



BASIC SEPARATION THEORY

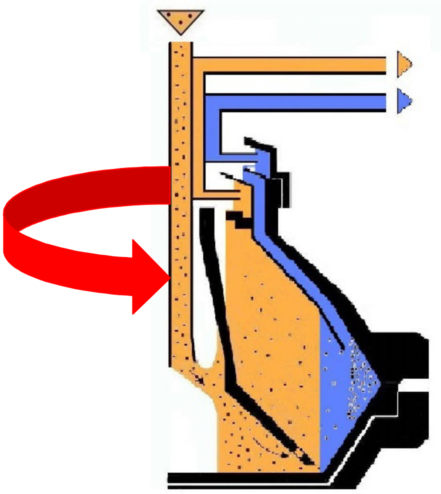
Conventional separator = A tank

- *Static separation*

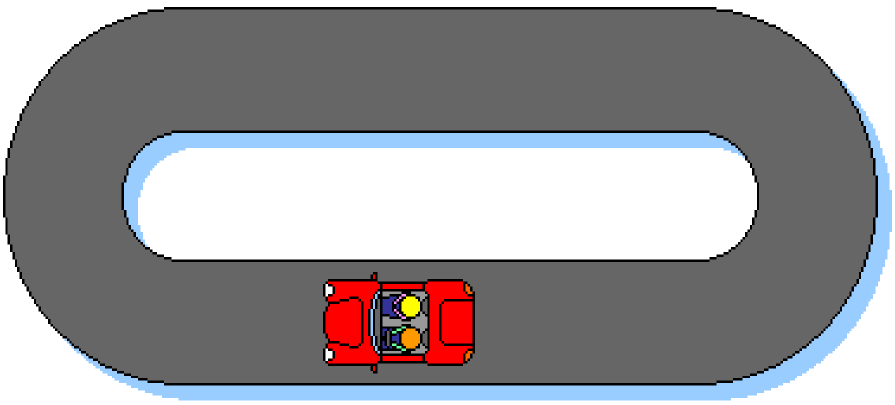


BASIC SEPARATION THEORY

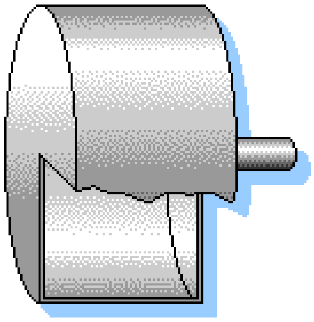
Conventional Separator = A Rotating Tank

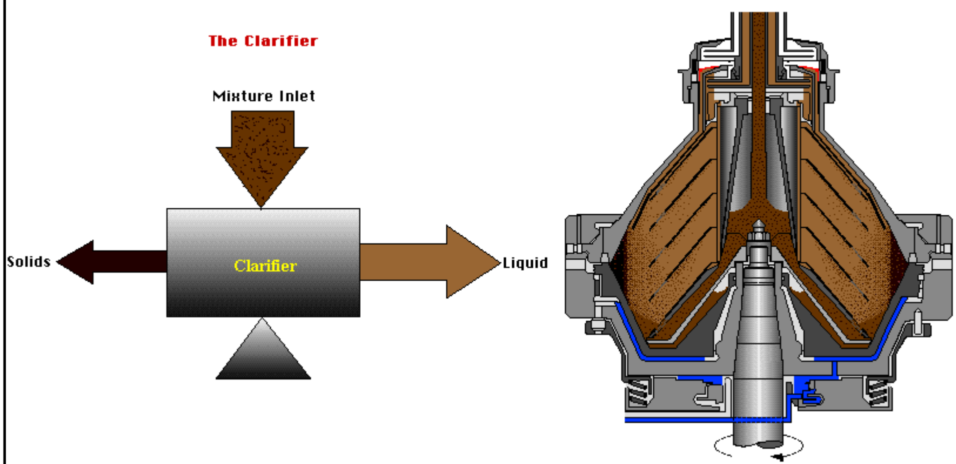


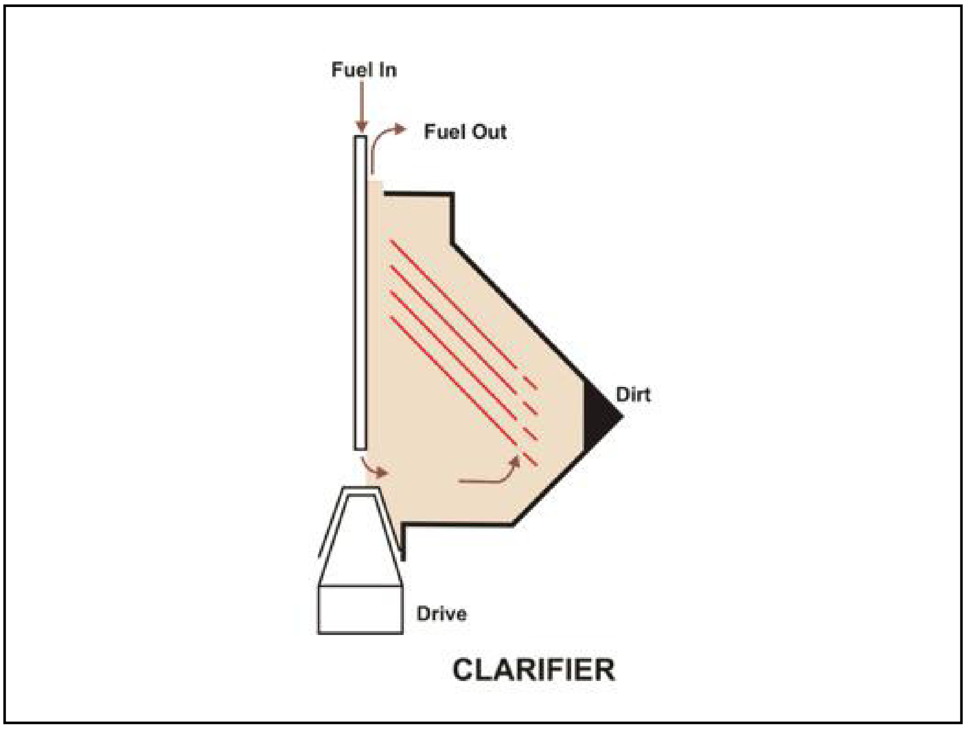
Centrifugal Force

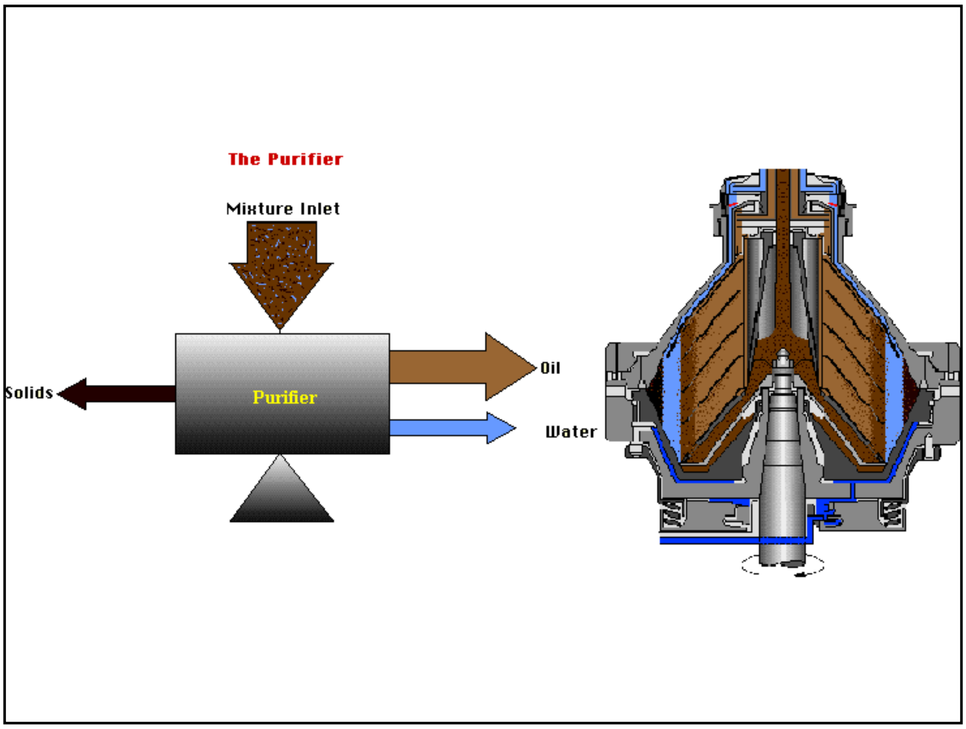


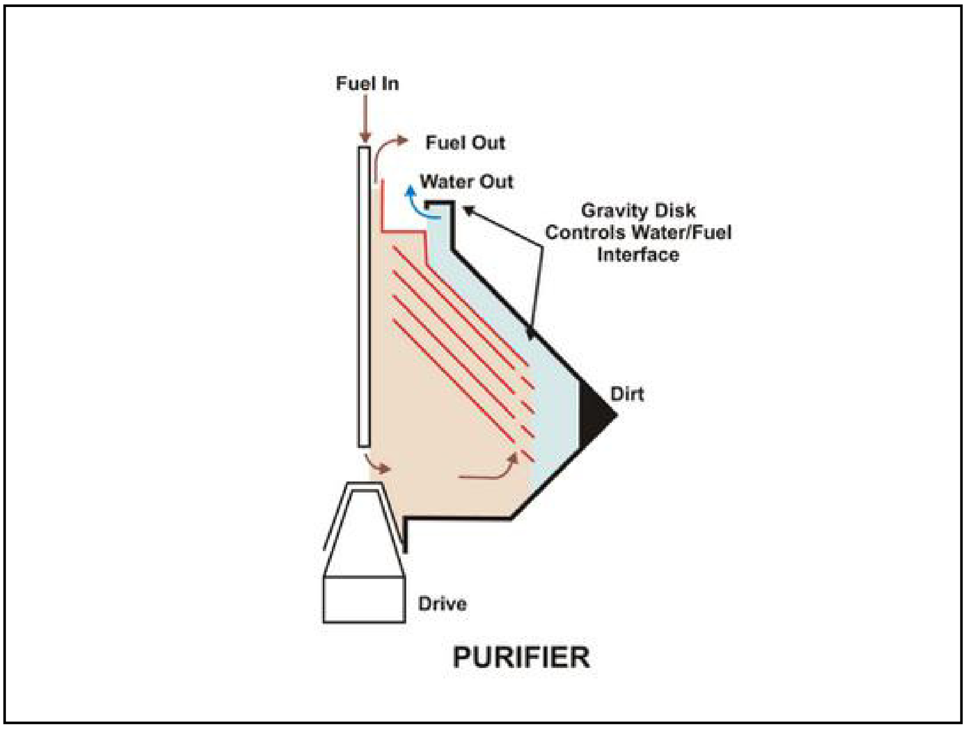
Centrifugal Separation

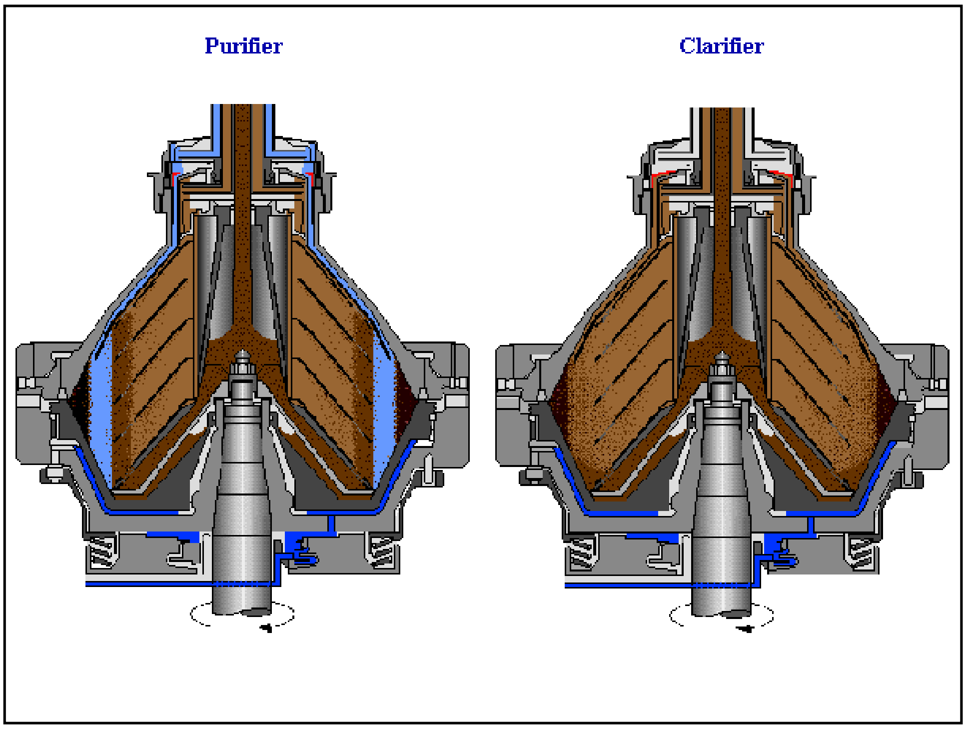


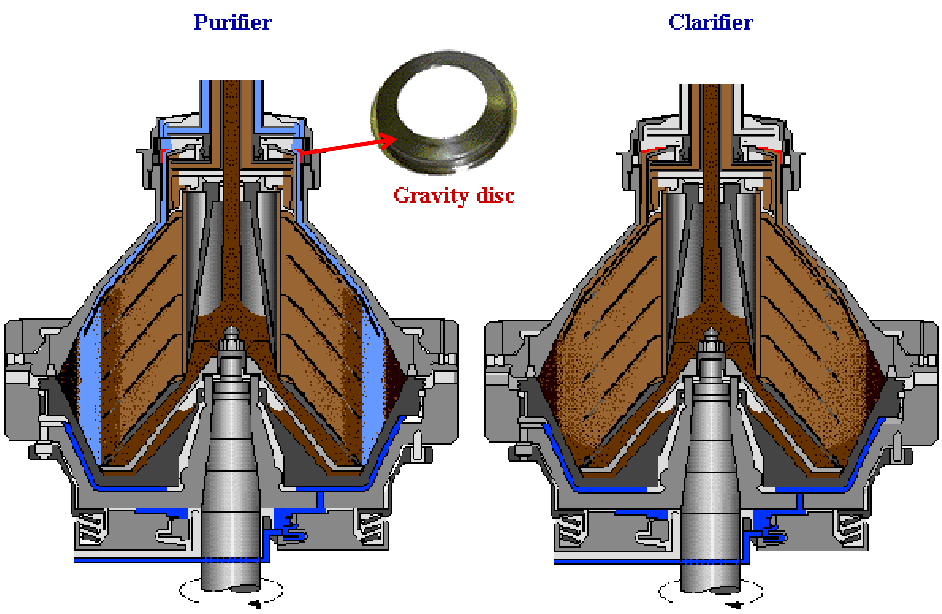



Fuel In
Fuel Out
Dirt
Drive
CLARIFIER


The Purifier
Mixture Inlet
Solids
Purifier
Oil
Water


Fuel In
Fuel Out
Water Out
Gravity Disk
Controls Water/Fuel
Interface
Dirt
Drive
PURIFIER

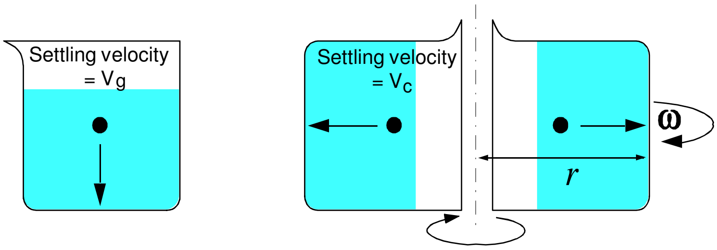

Purifier
Clarifier



Centrifugal Separation

Forced coalescense / sedimentation

Settling velocity stated by Stokes´ Law

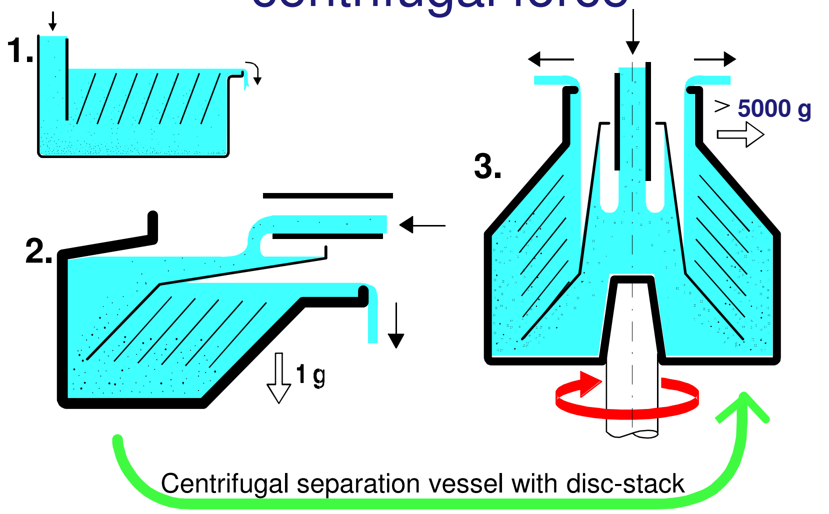


Gravity separation.
Driving force: 1g

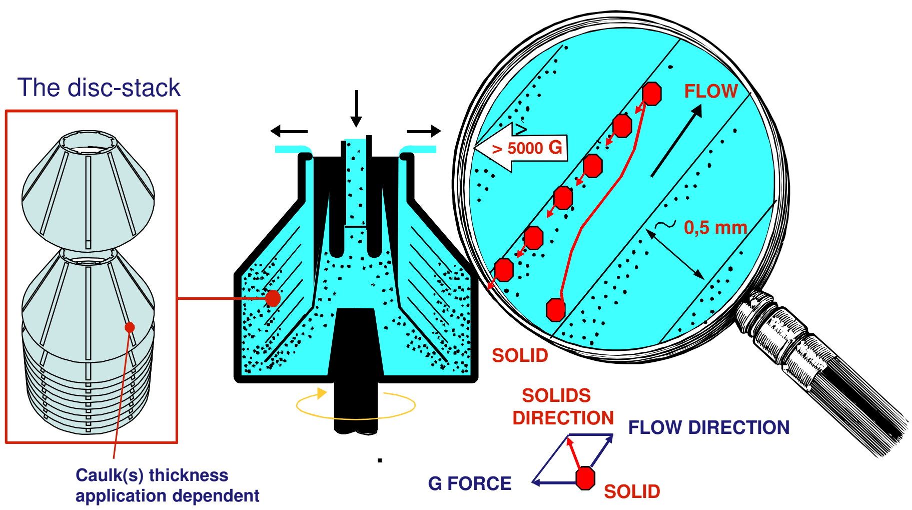
Centrifugal separation.
Driving force: r ω^2

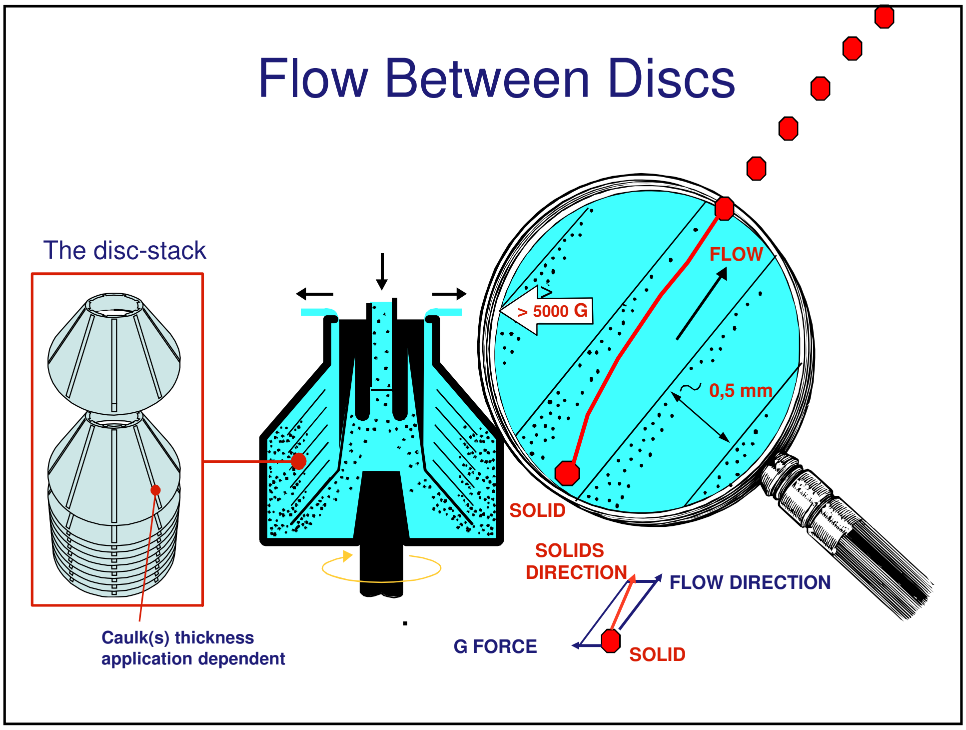
$$V_c = \frac{d^2(\rho_p - \rho_l)}{18\eta} r\omega^2$$

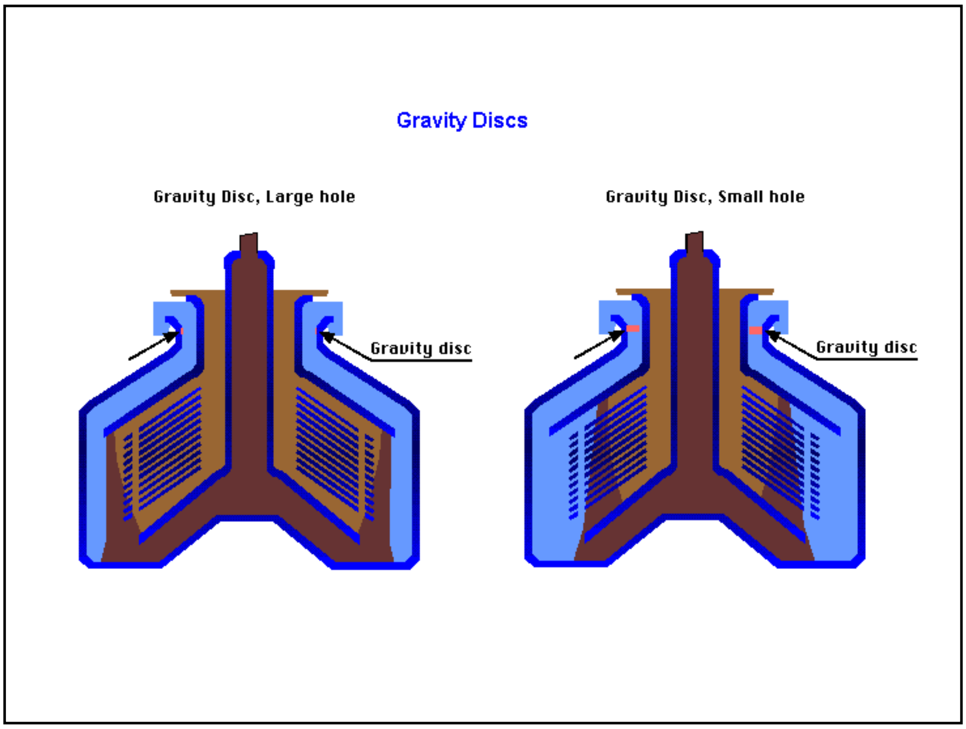
From gravitational to centrifugal force

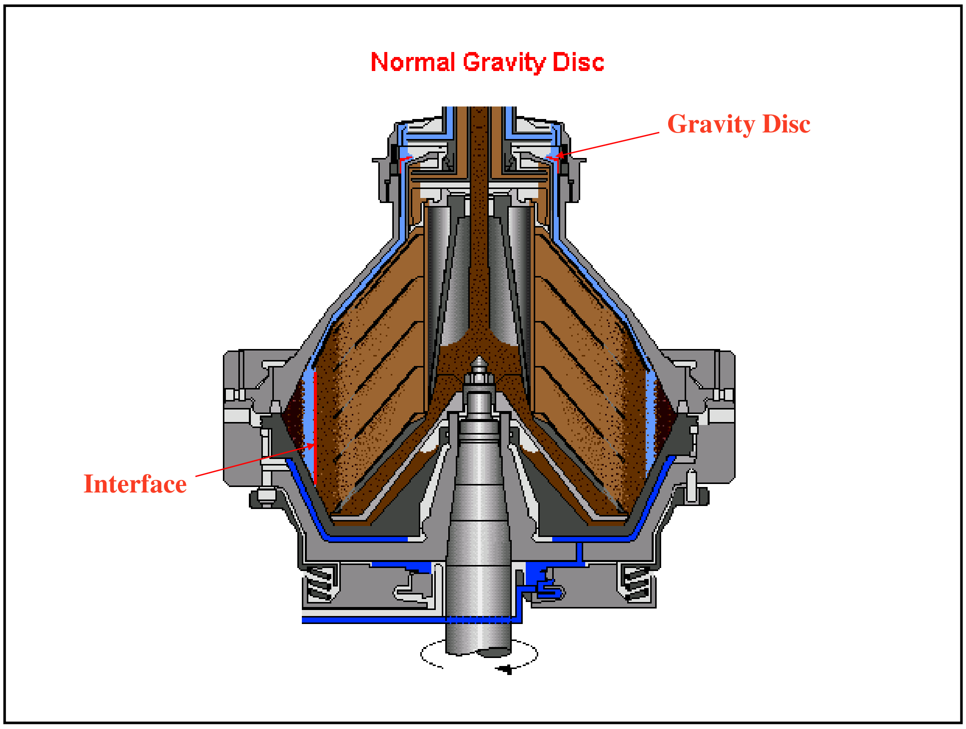


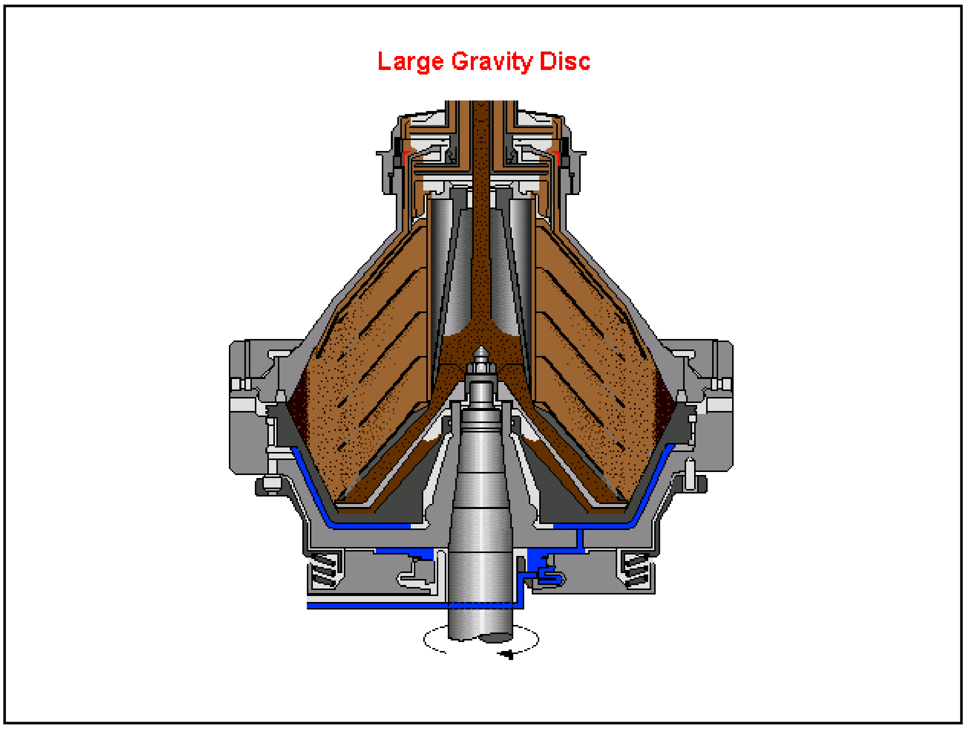
Flow Between Discs

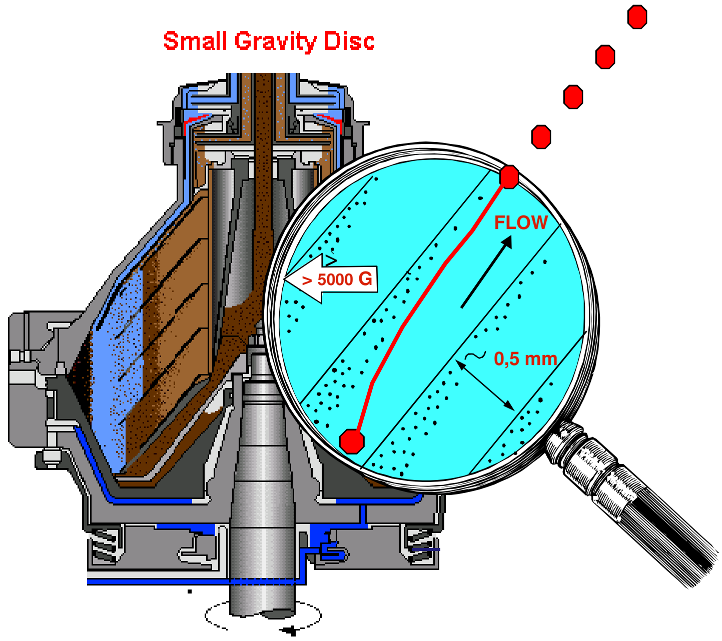


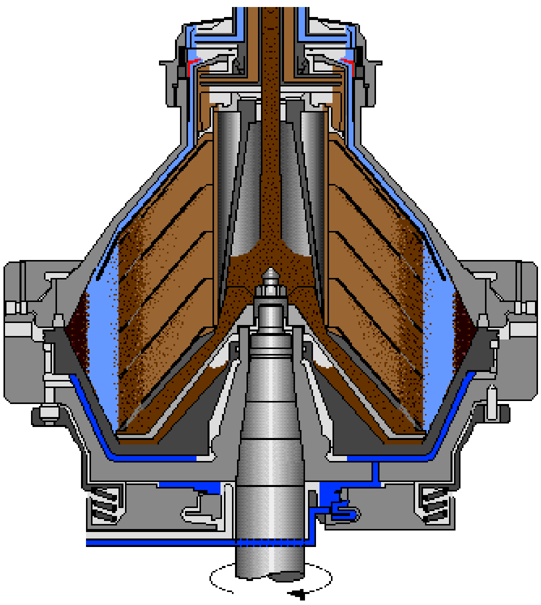

Flow Between Discs
The disc-stack
Caulk(s) thickness
application dependent
> 5000 G
FLOW
0,5 mm
SOLID
SOLIDS
DIRECTION
FLOW DIRECTION
G FORCE
SOLID


Gravity Discs
Gravity Disc, Large hole
Gravity Disc, Small hole
Gravity disc
Gravity disc


Normal Gravity Disc
Gravity Disc
Interface


Large Gravity Disc

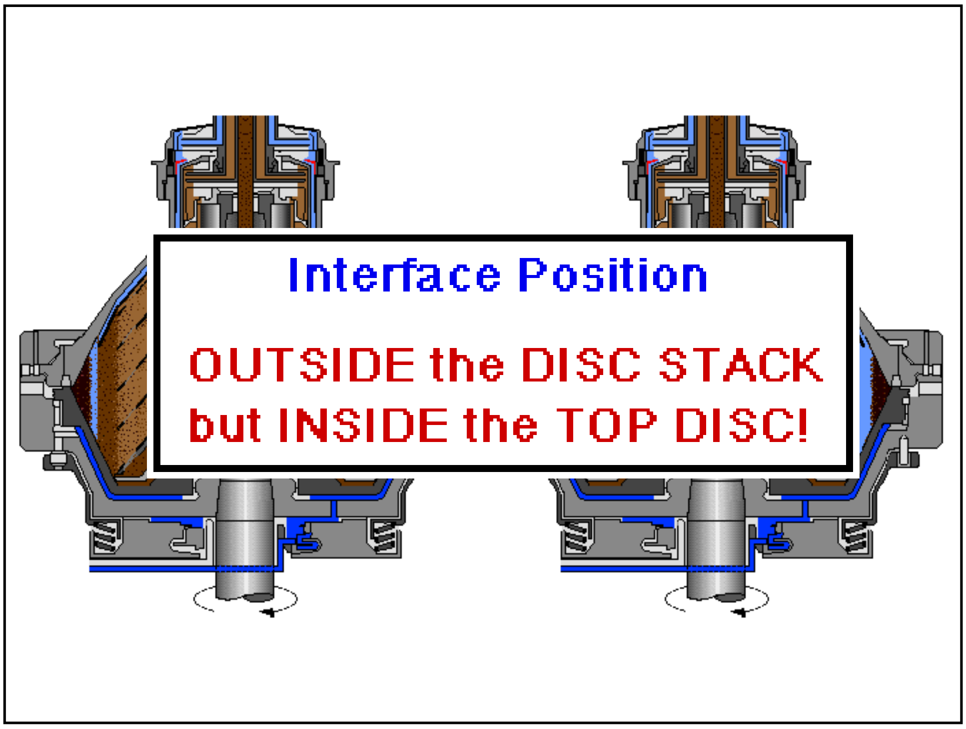


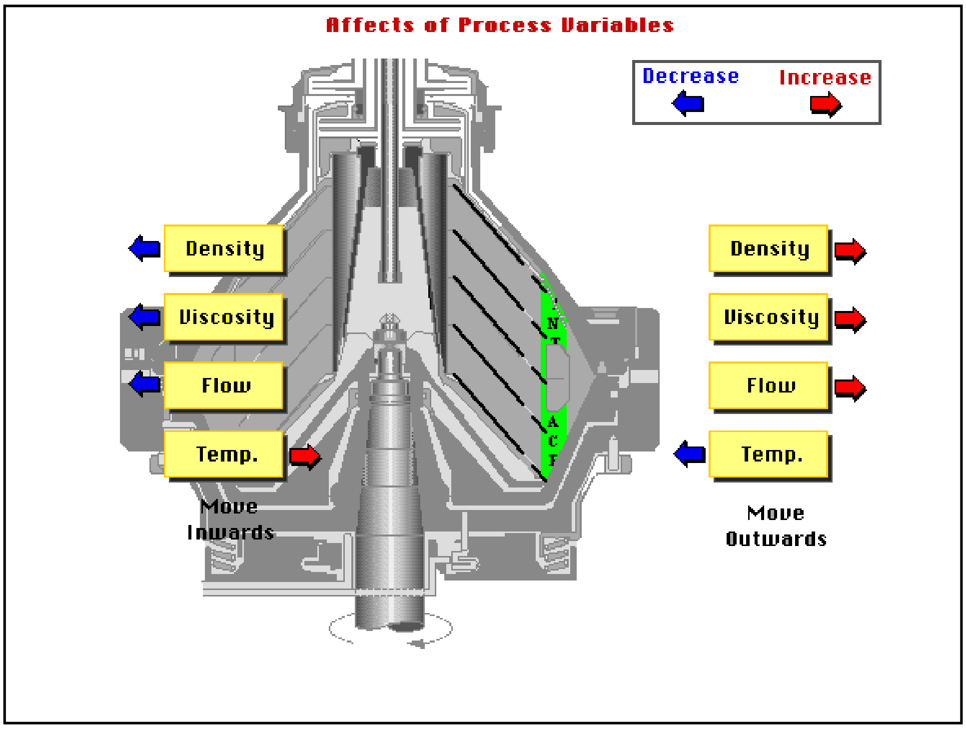


The Interface

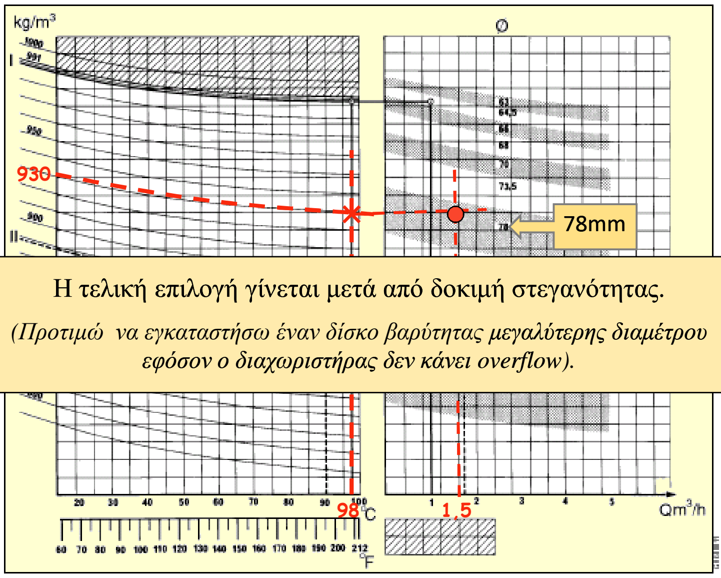
The Interface must never reach the disc stack or pass the outer edge of the top disc. Parameters affecting the position of the interface are:

- Density
- Viscosity
- Temperature
- Flow


Interface Position
OUTSIDE the DISC STACK
but INSIDE the TOP DISC!


Affects of Process Variables
Decrease
Increase
Density
Viscosity
Flow
Temp.
Move
Inwards
Density
Viscosity
Flow
Temp.
Move
Outwards

Gravity disc nomogram



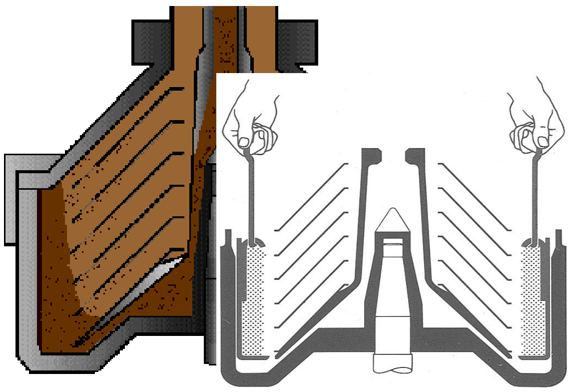
Η τελική επιλογή γίνεται μετά από δοκιμή στεγανότητας.

(Προτιμώ να εγκαταστήσω έναν δίσκο βαρύτητας μεγαλύτερης διαμέτρου εφόσον ο διαχωριστήρας δεν κάνει overflow).

Επιλογή δίσκου βαρύτητας για τον καθαρισμό **F.O.** πυκνότητας **930 Kg/m³** @ 15°C, παροχή στον διαχωριστήρα **1,5 m³/h** και θερμοκρασία καθαρισμού **98 °C**.

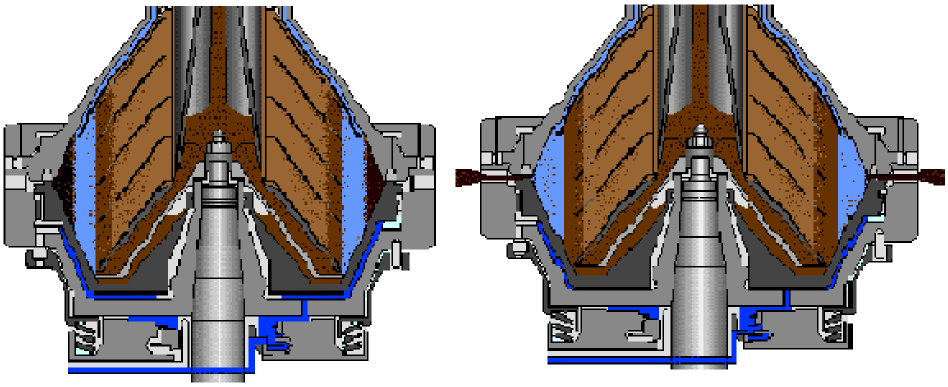
Solids-retaining Separator

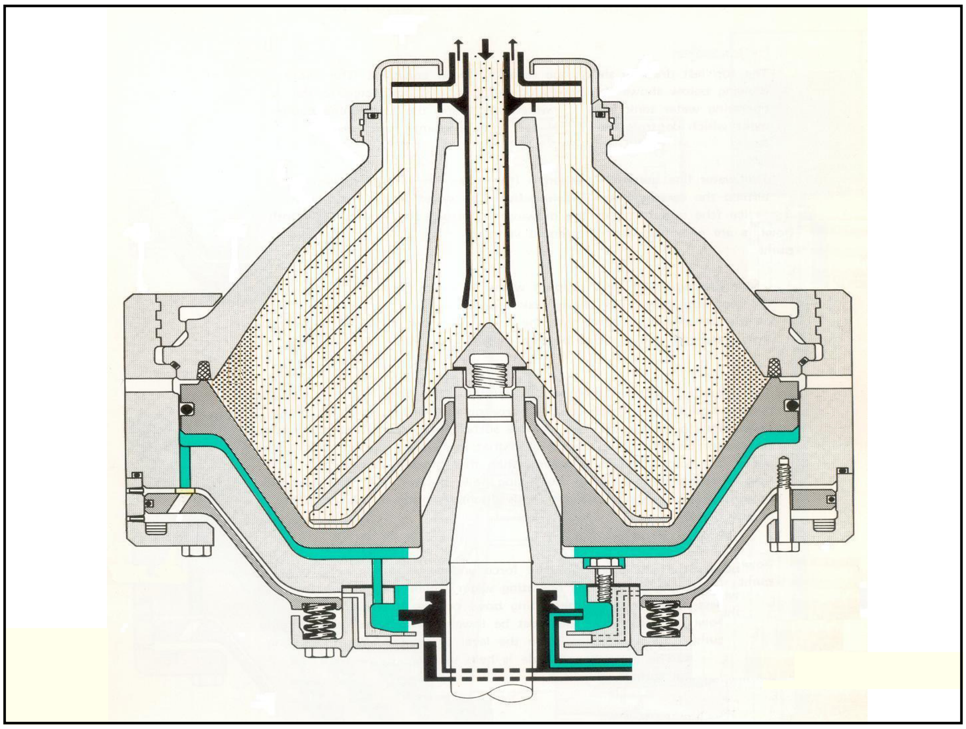
It's used for separating liquid mixtur that have only a low amount of solids in them – approximatly 0.1%.

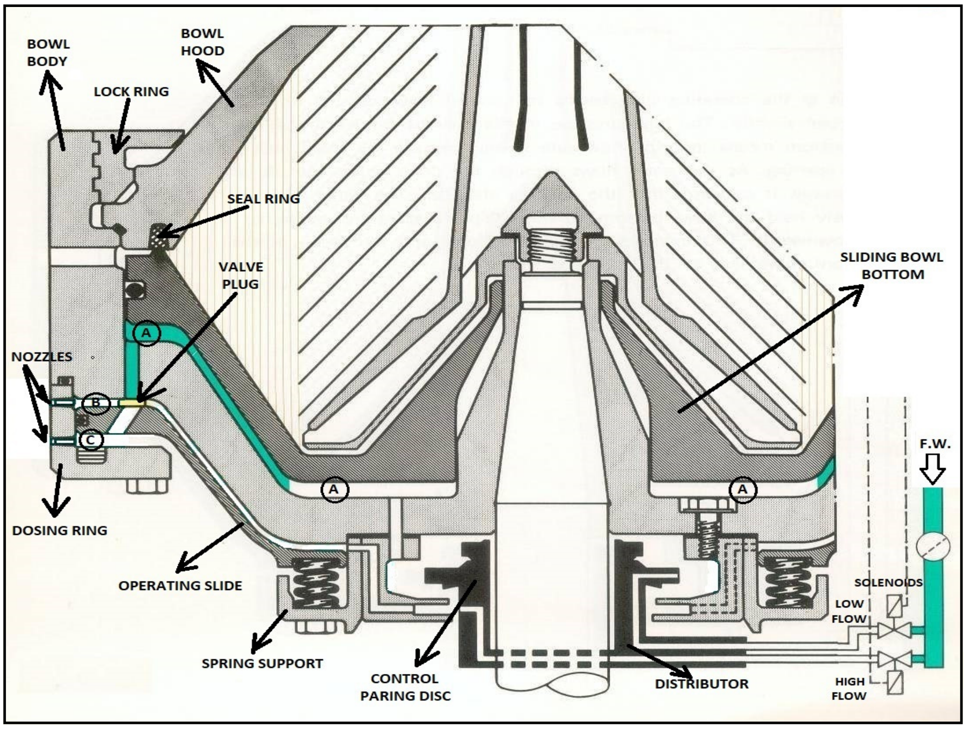


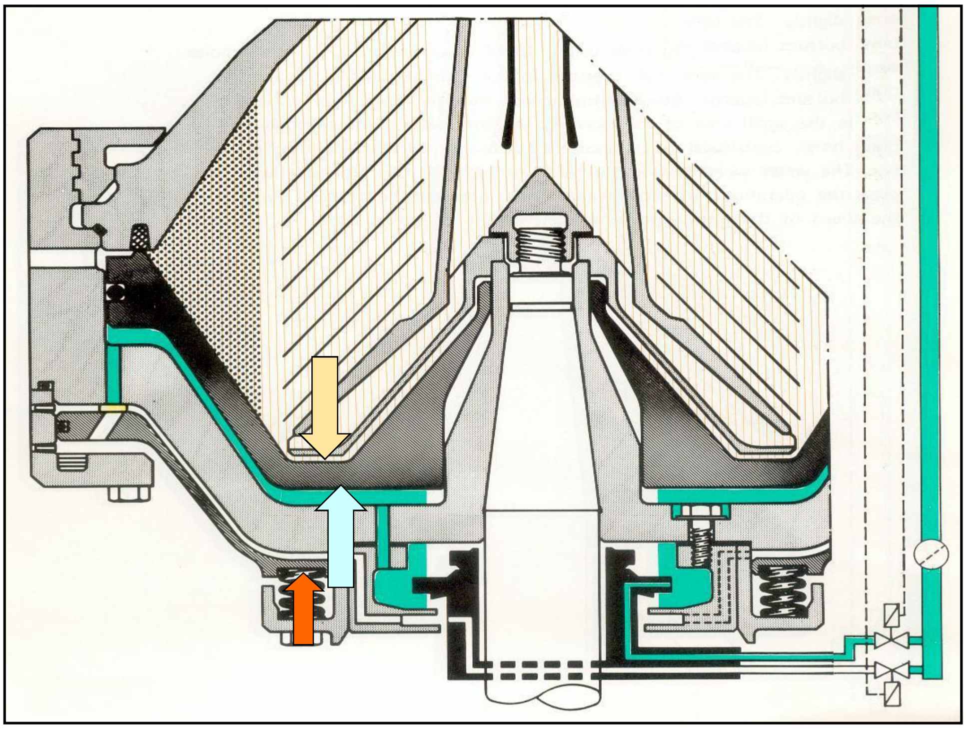
Solids-ejecting Separator

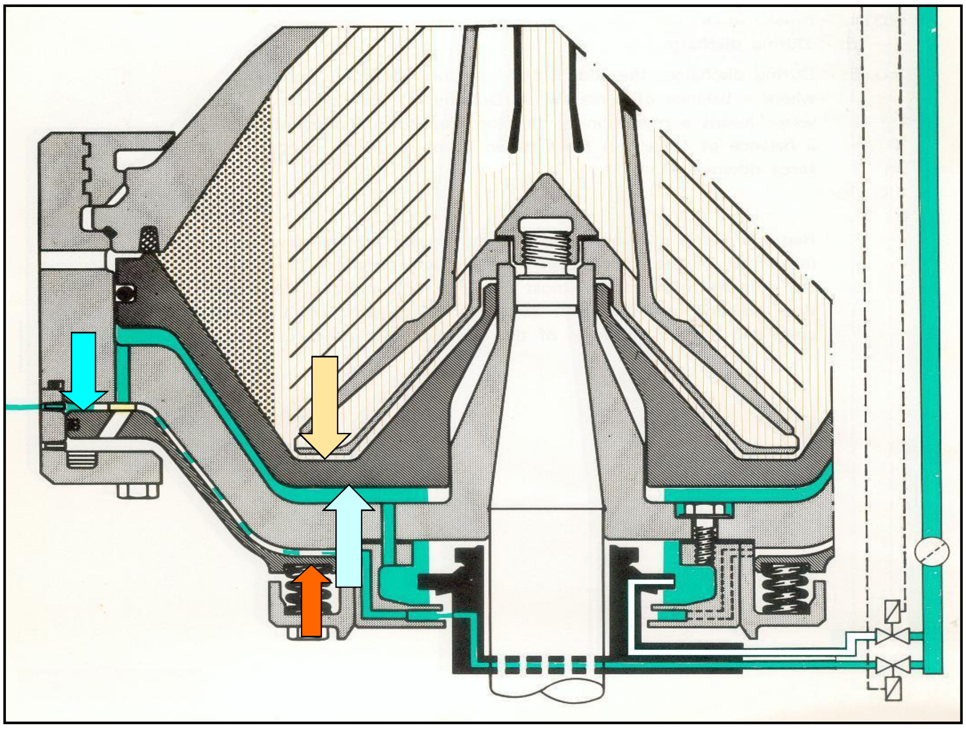
For liquids with a higher solid content up to 10 %
or when it's undesirable to stop the machine for emptying.

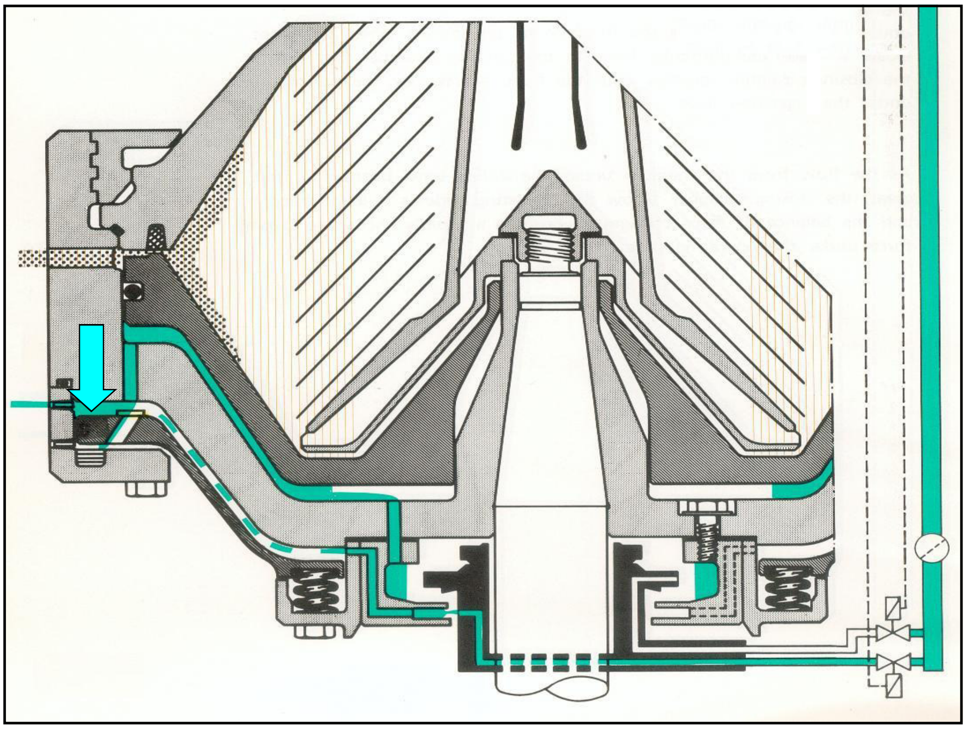


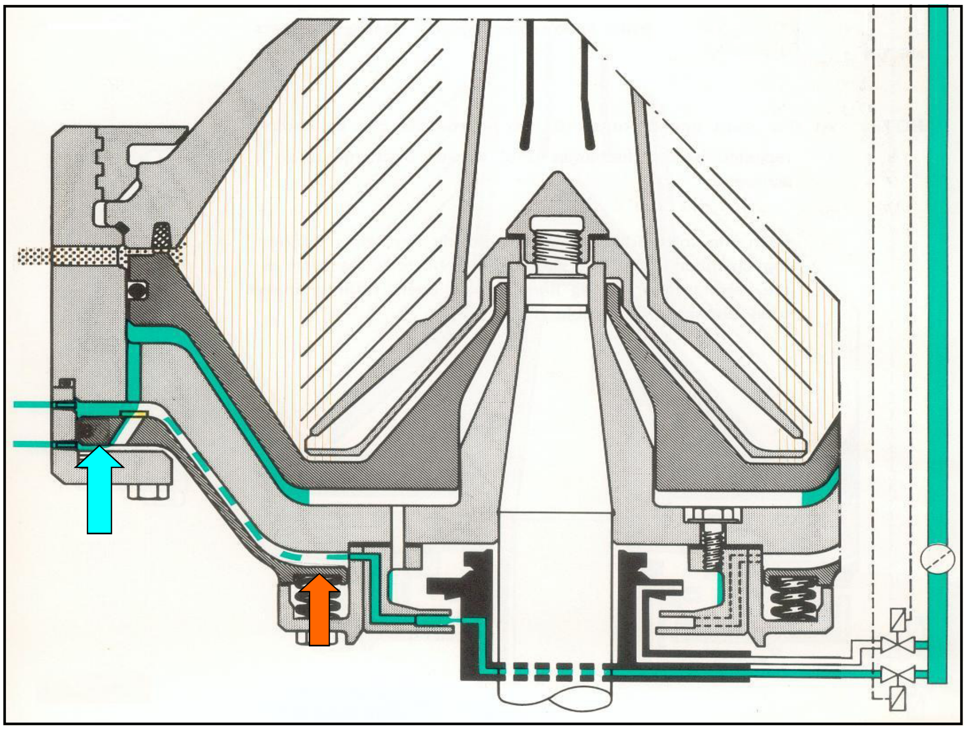


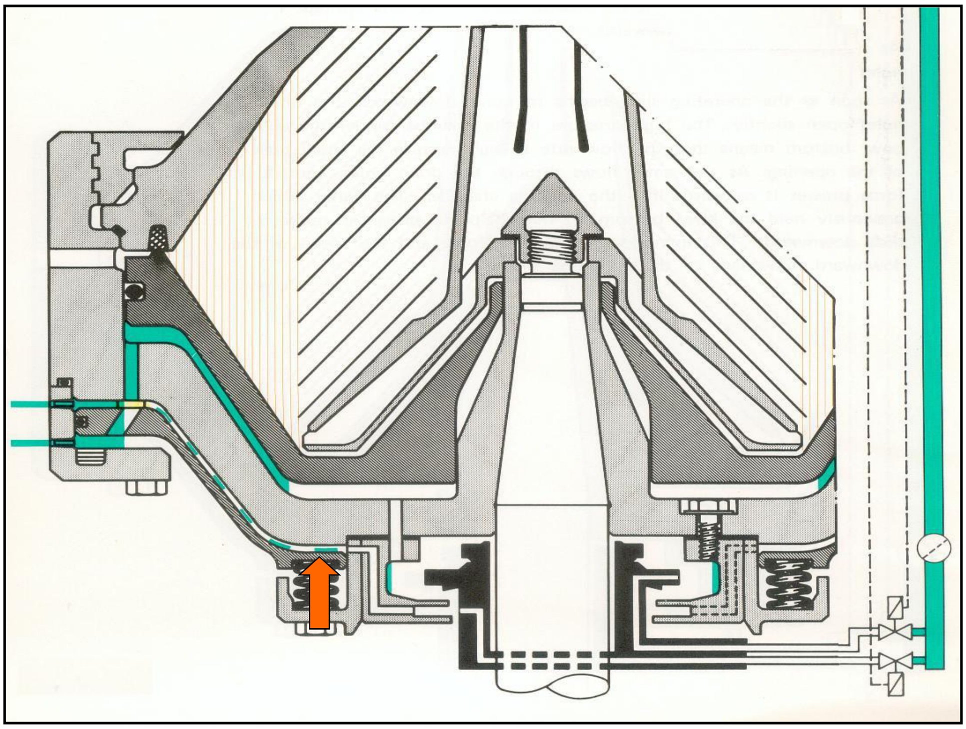

BOWL BODY
BOWL HOOD
LOCK RING
SEAL RING
VALVE PLUG
NOZZLES
DOSING RING
OPERATING SLIDE
SPRING SUPPORT
CONTROL PARING DISC
DISTRIBUTOR
SLIDING BOWL BOTTOM
F.W.
SOLENOIDS
LOW FLOW
HIGH FLOW
A
B
C

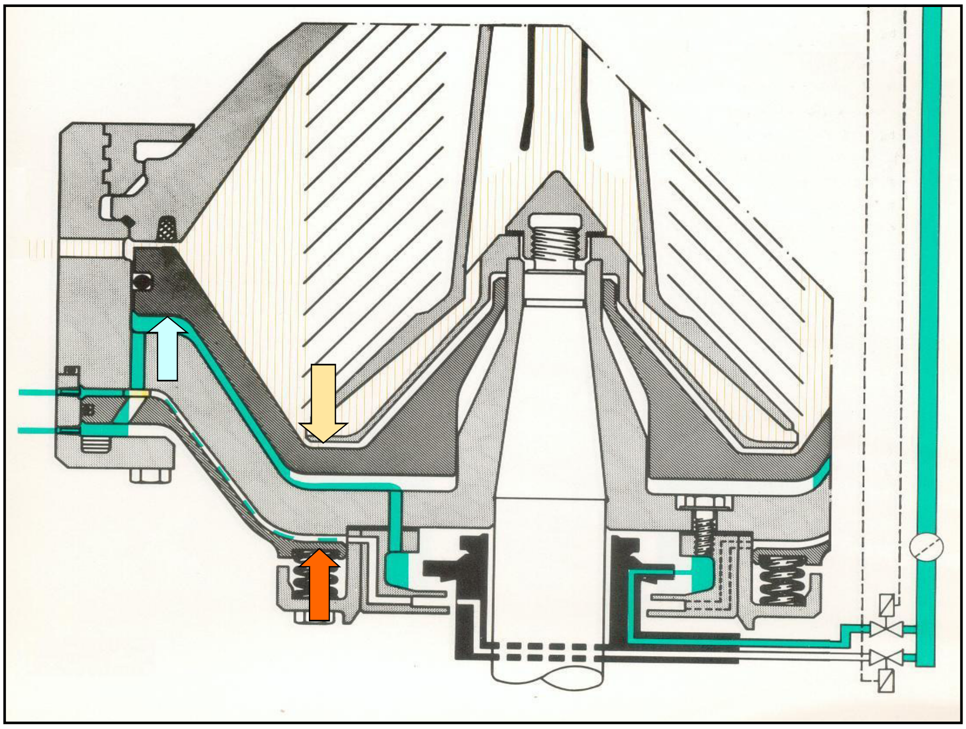


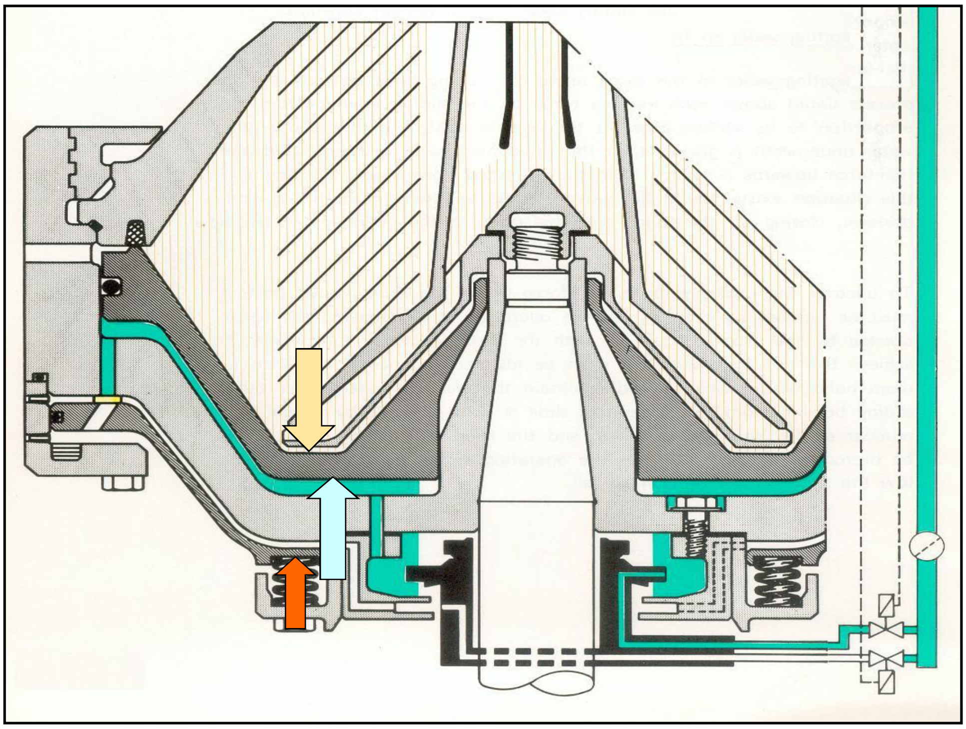


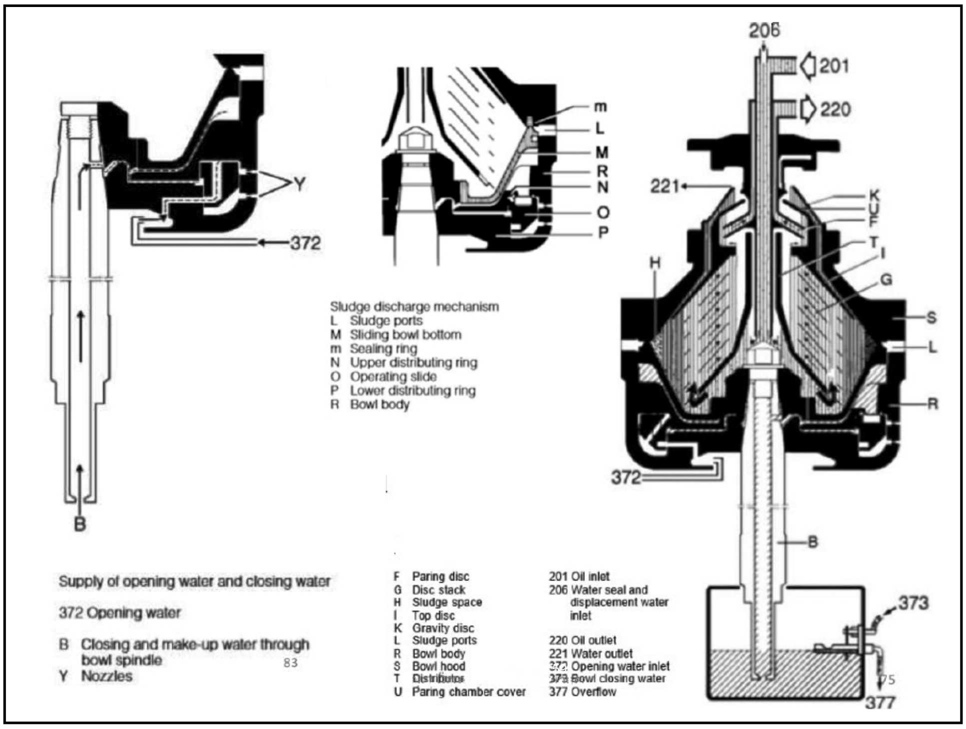


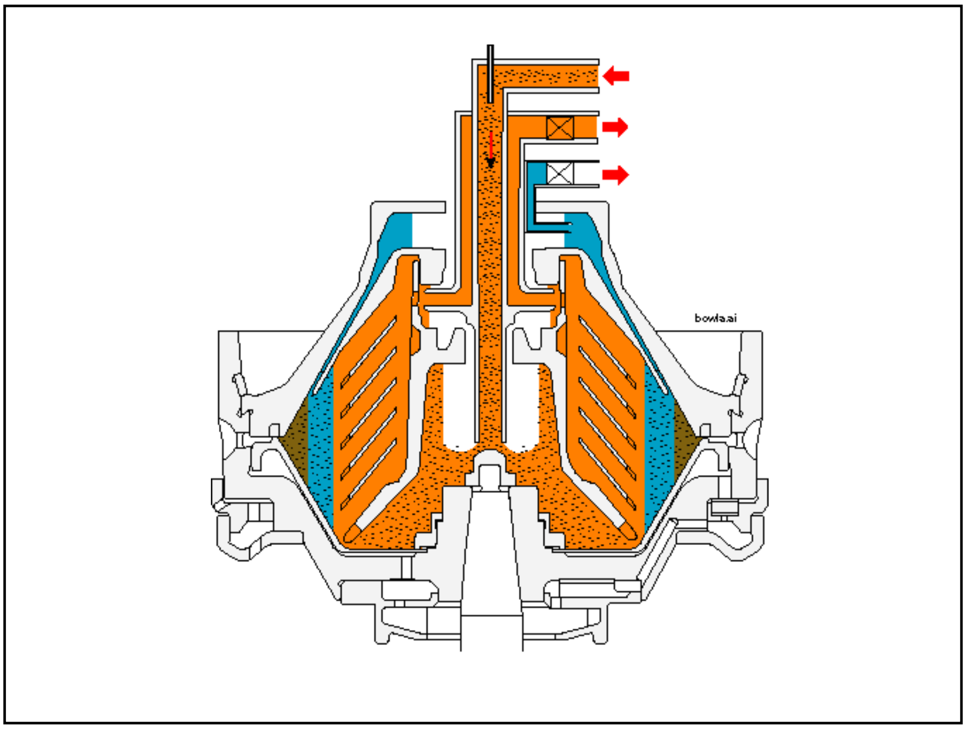




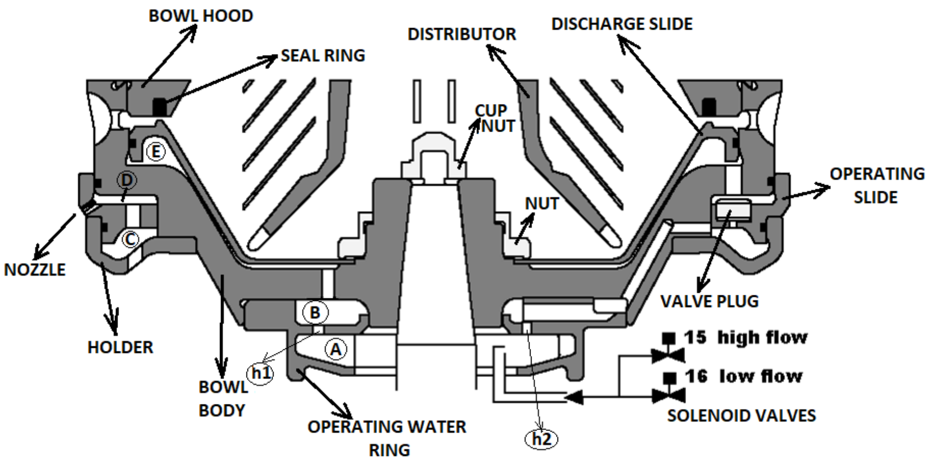




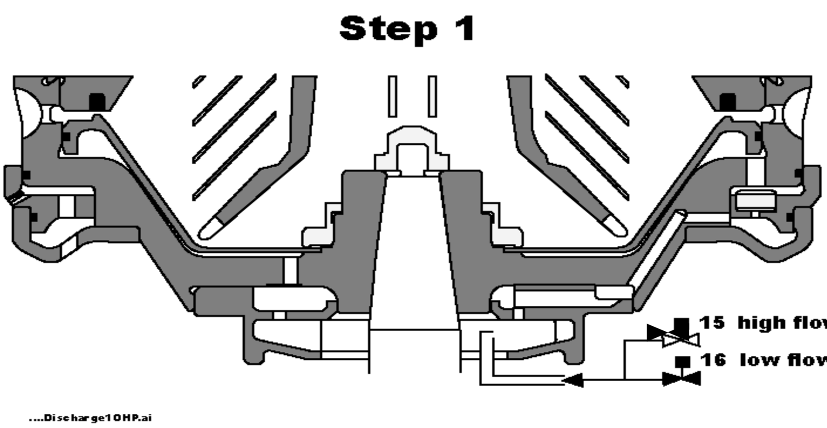

Y
372
B
Supply of opening water and closing water
372 Opening water
B Closing and make-up water through bowl spindle
Y Nozzles
m
L
M
R
N
O
P
Sludge discharge mechanism
L Sludge ports
M Sliding bowl bottom
m Sealing ring
N Upper distributing ring
O Operating slide
P Lower distributing ring
R Bowl body
206
201
220
221
K
U
F
T
I
H
G
S
L
R
372
B
373
377
F Paring disc
G Disc stack
H Sludge space
I Top disc
K Gravity disc
L Sludge ports
R Bowl body
S Bowl hood
T Distributor
U Paring chamber cover
201 Oil inlet
206 Water seal and displacement water inlet
220 Oil outlet
221 Water outlet
372 Opening water inlet
373 Bowl closing water
377 Overflow


bowla.ai

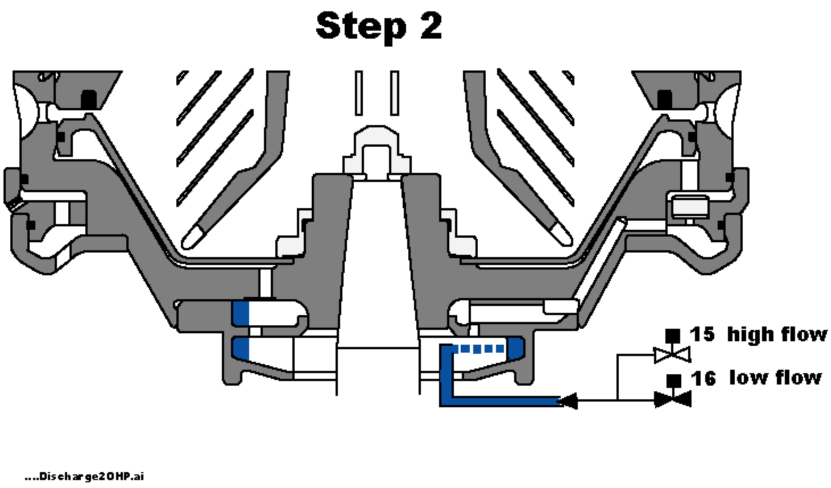
The operating mechanism



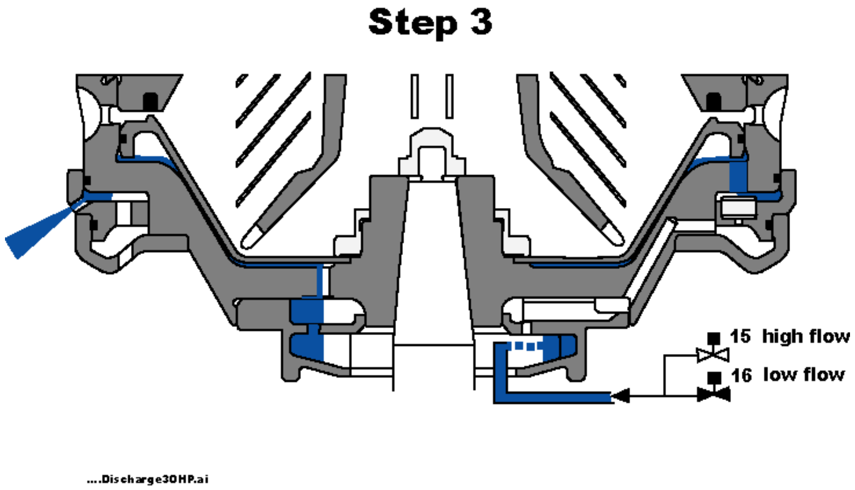
The operating mechanism



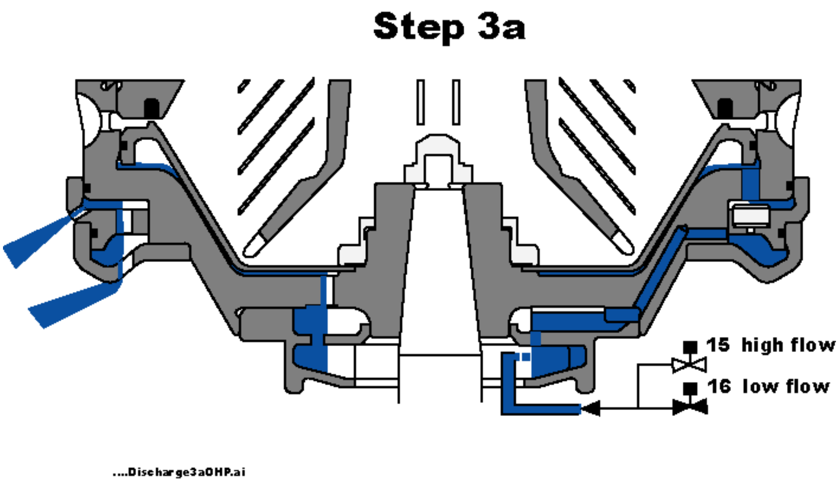
The operating mechanism



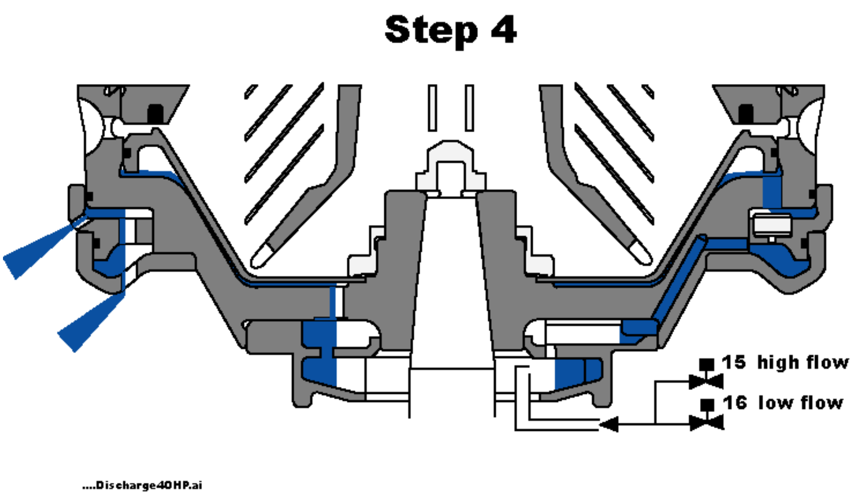
The operating mechanism



The operating mechanism

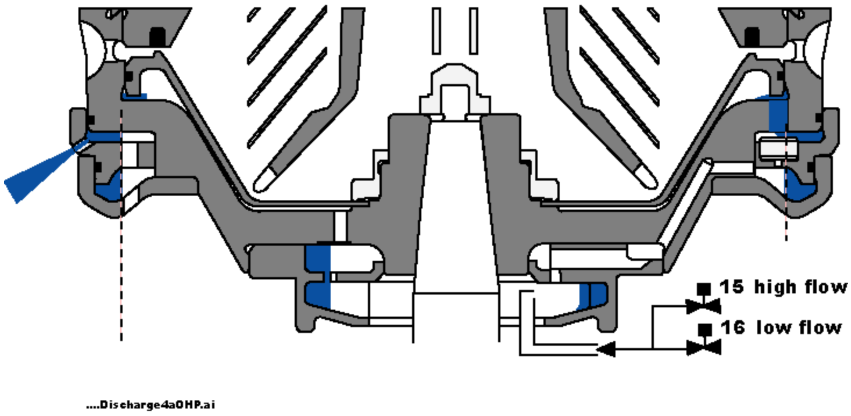


The operating mechanism



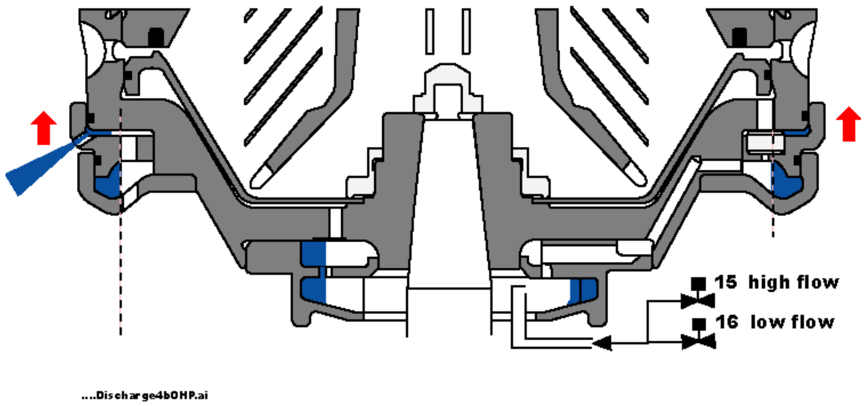
The operating mechanism

Step 4a



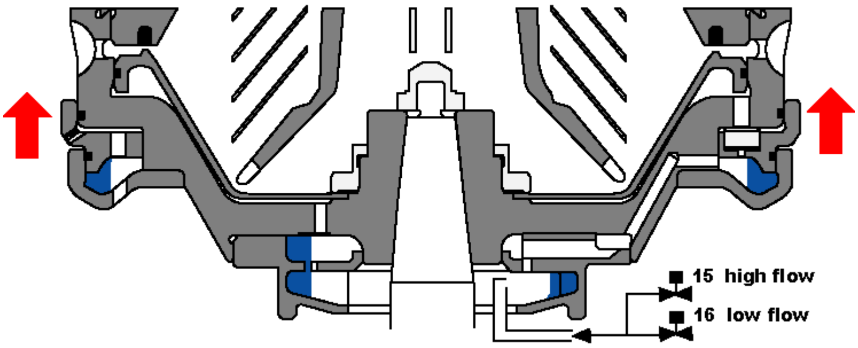
The operating mechanism

Step 4b



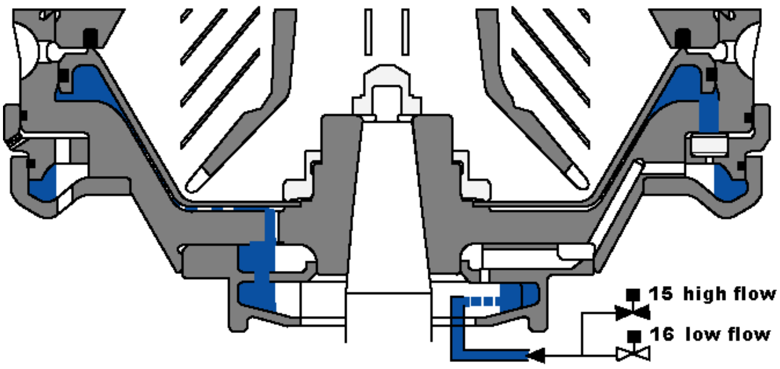
The operating mechanism

Step 4c



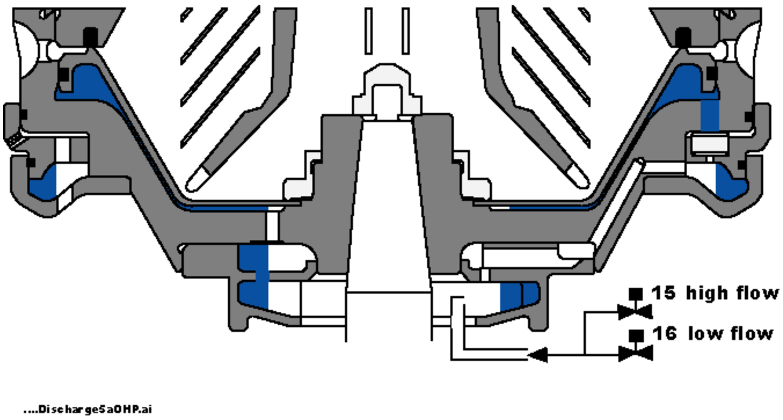
The operating mechanism

Step 5



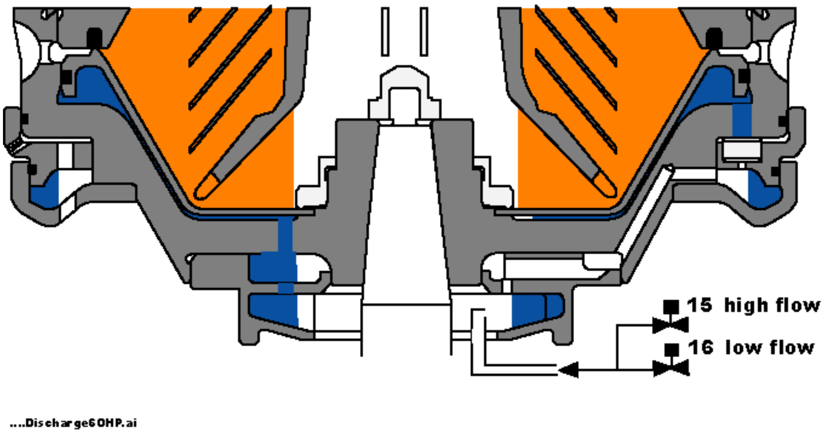
The operating mechanism

Step 5a



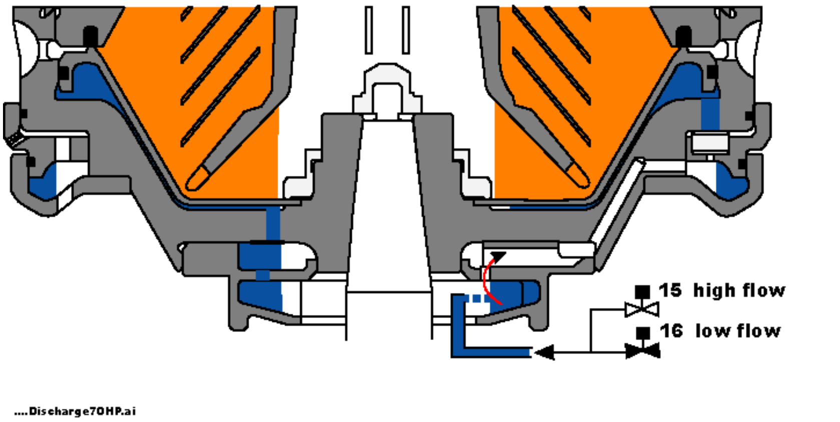
The operating mechanism

Step 6



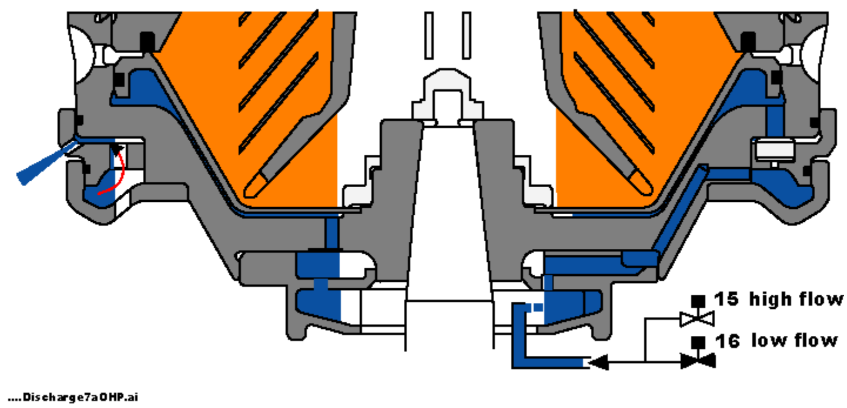
The operating mechanism

Step 7

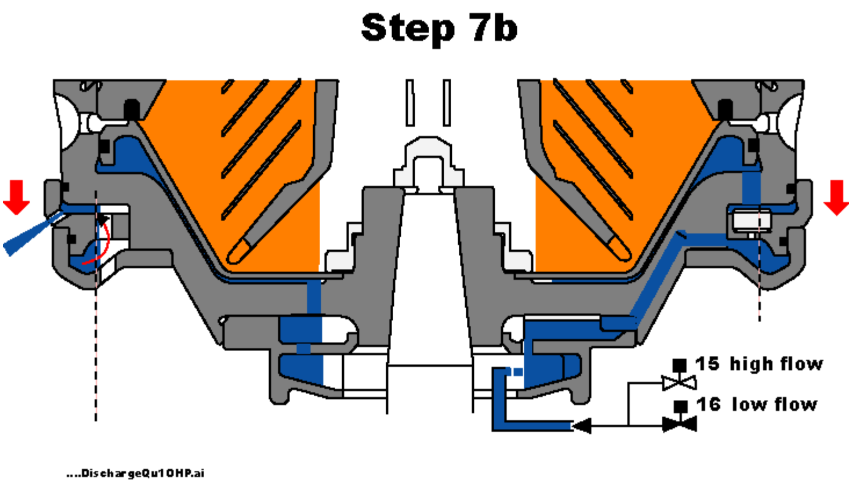


The operating mechanism

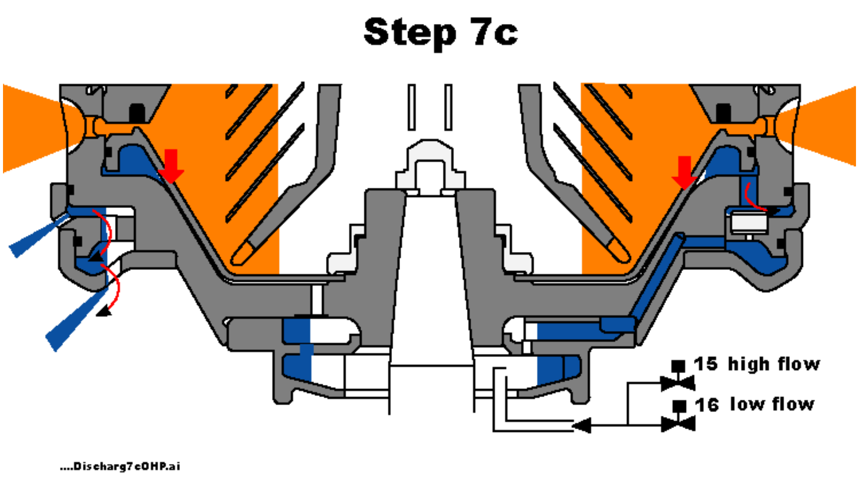
Step 7a

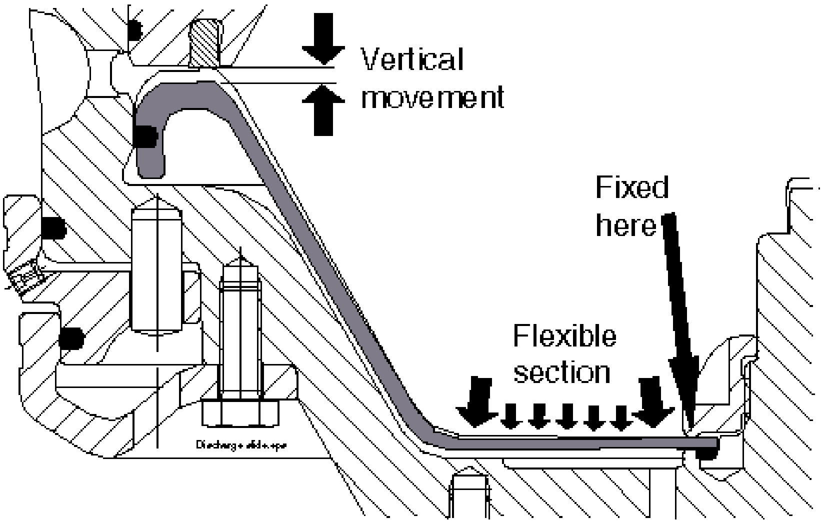


The operating mechanism



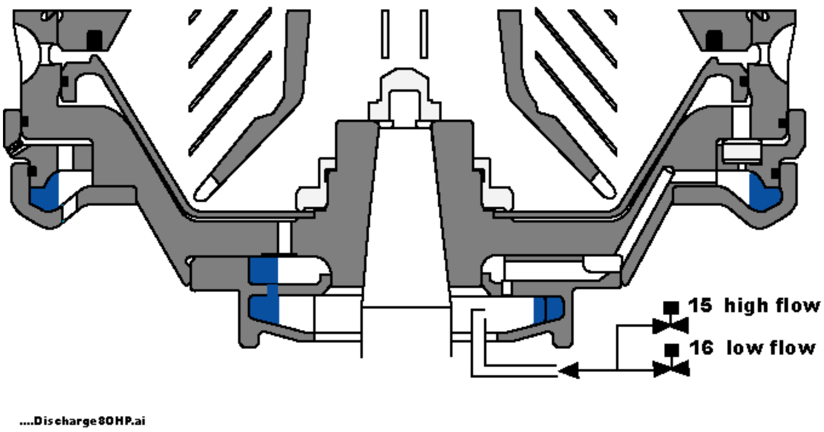
The operating mechanism

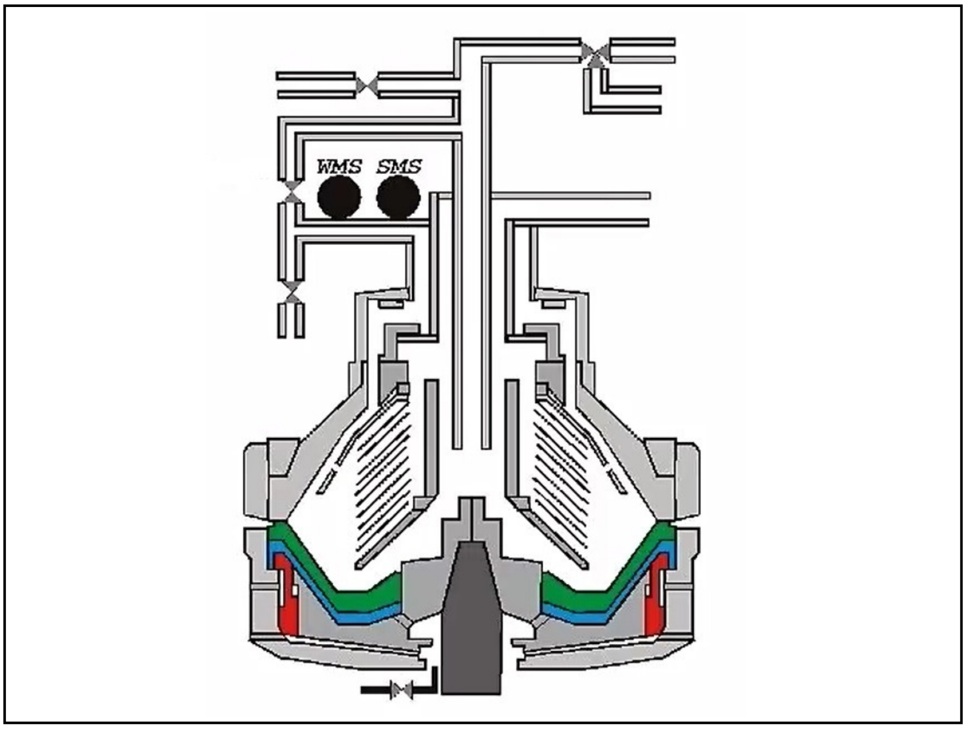


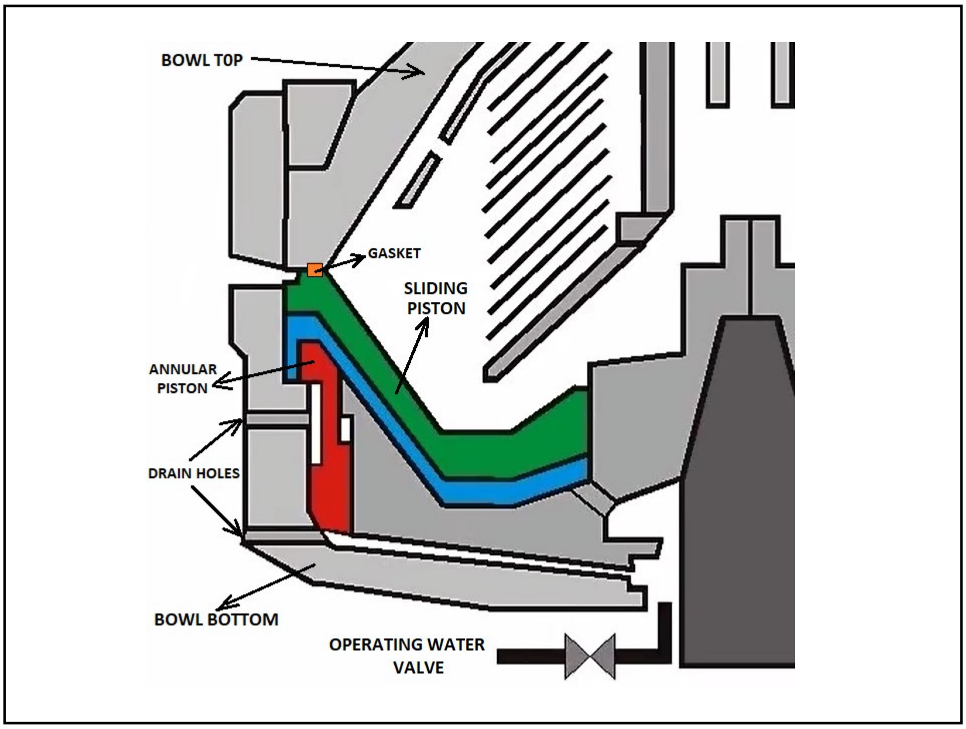


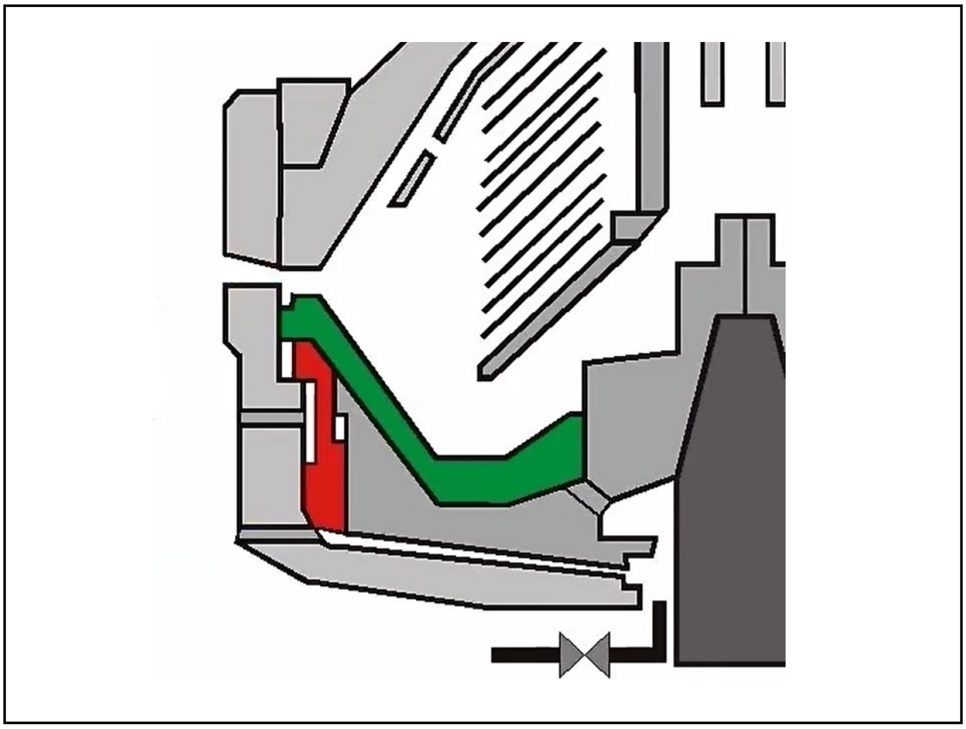
The operating mechanism

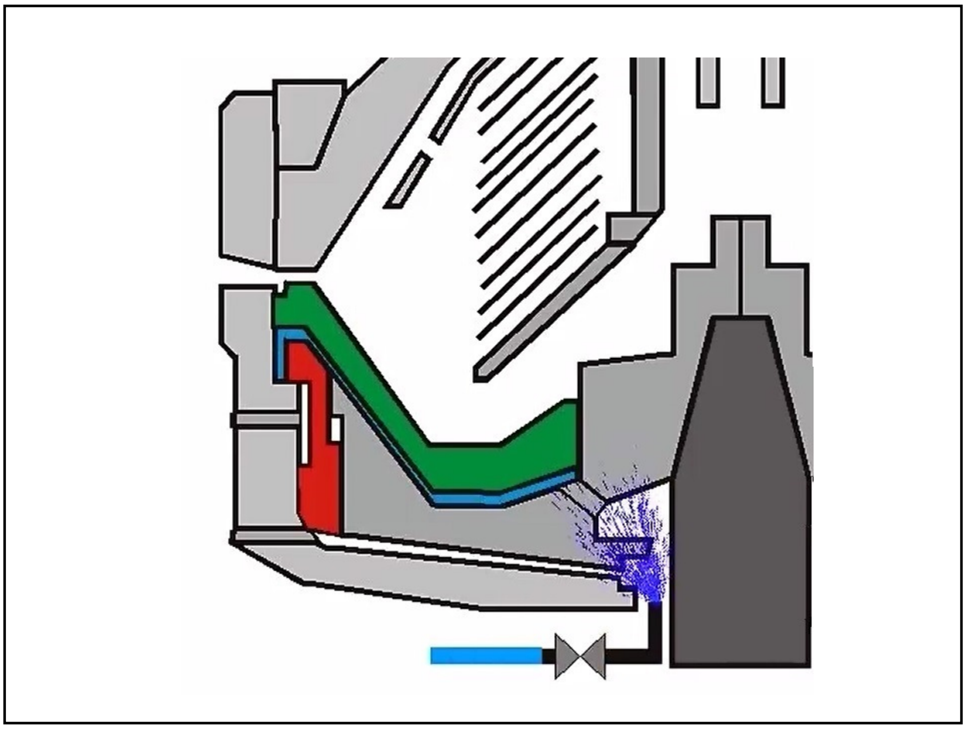
Step 8

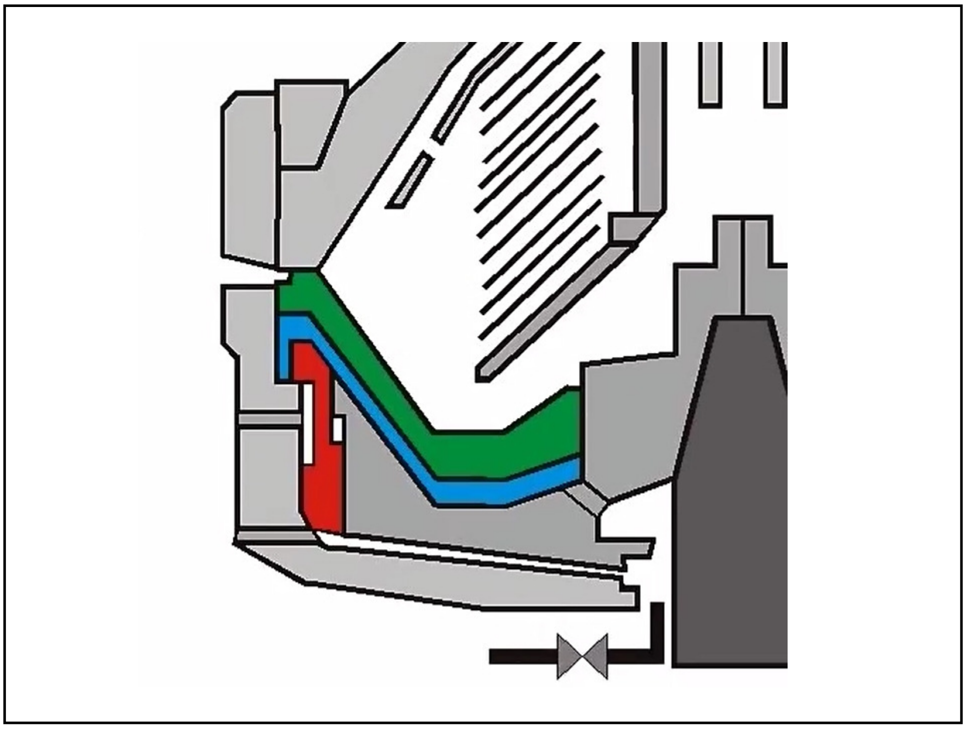


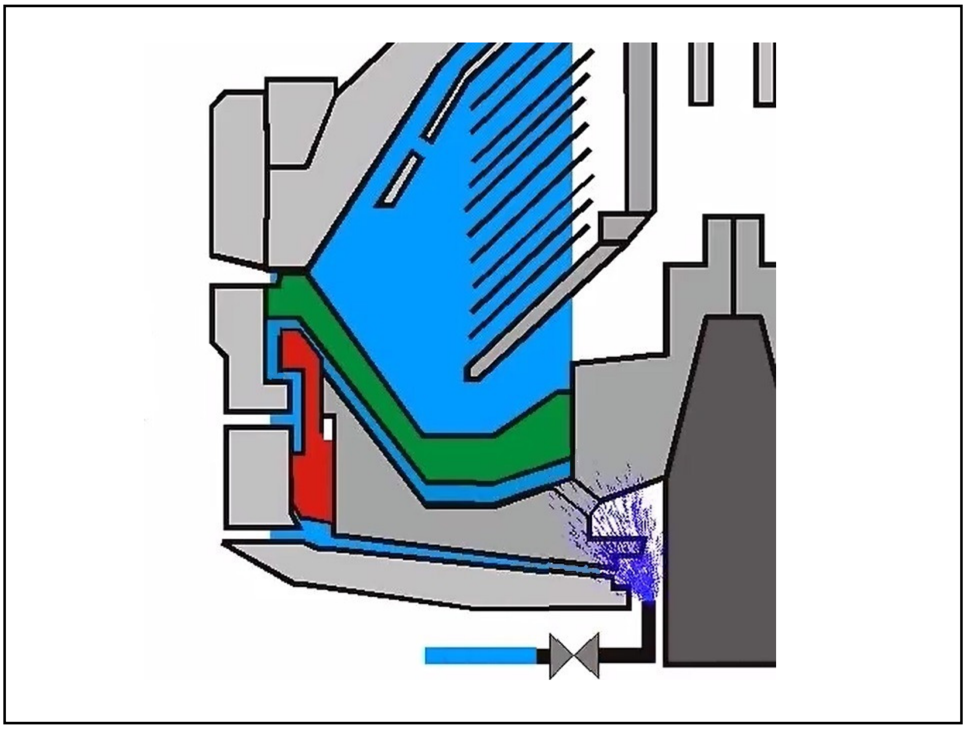

WMS
SMS

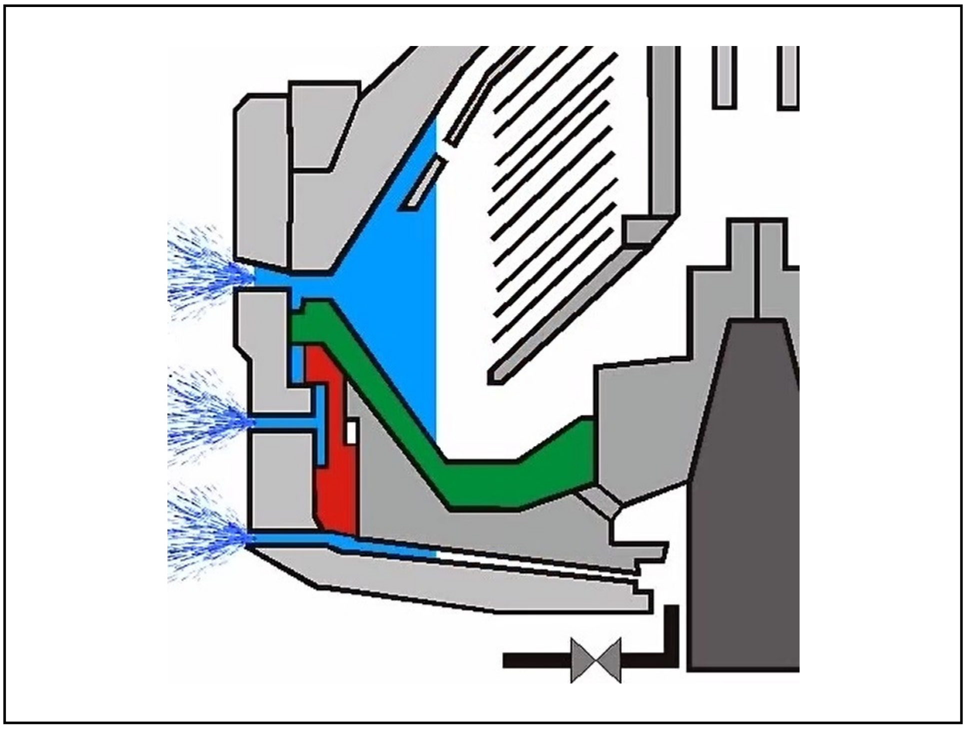

BOWL TOP
GASKET
SLIDING PISTON
ANNULAR PISTON
DRAIN HOLES
BOWL BOTTOM
OPERATING WATER VALVE

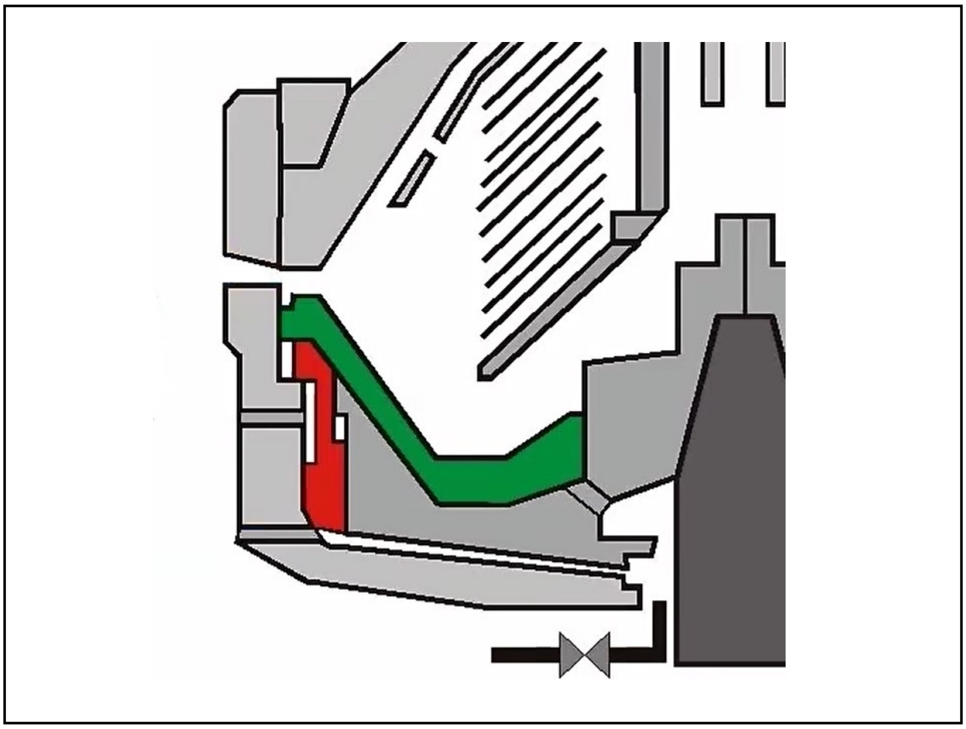




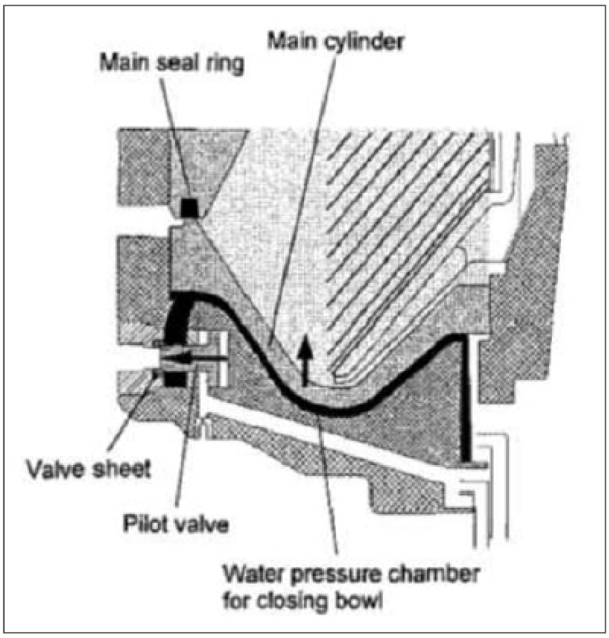




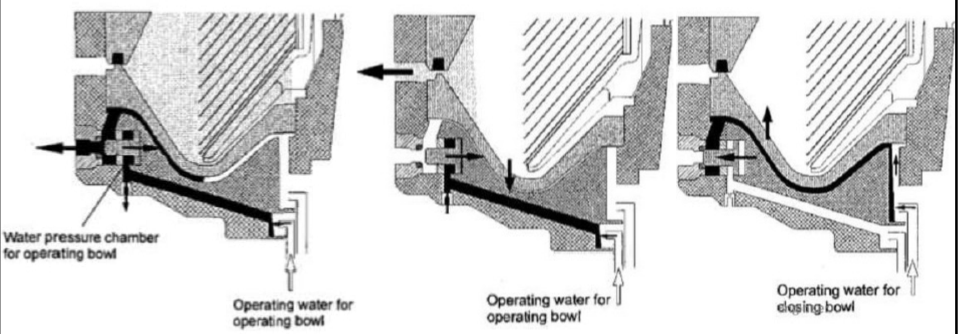


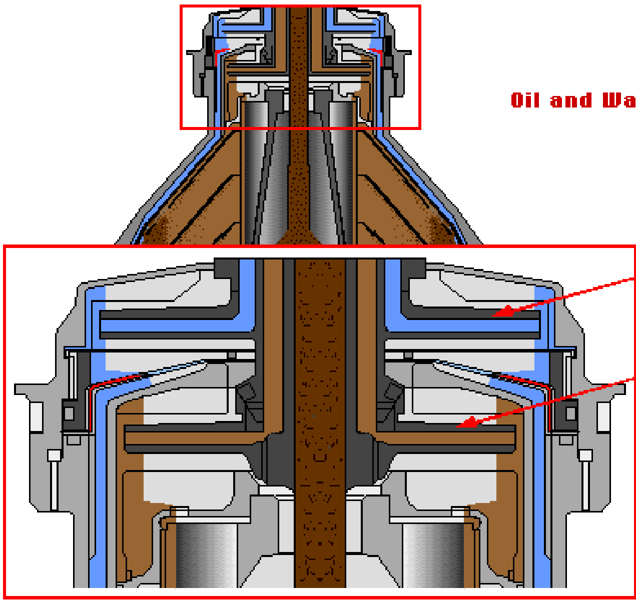


MITSUBISHI - SELFJECTOR



MITSUBISHI - SELFJECTOR



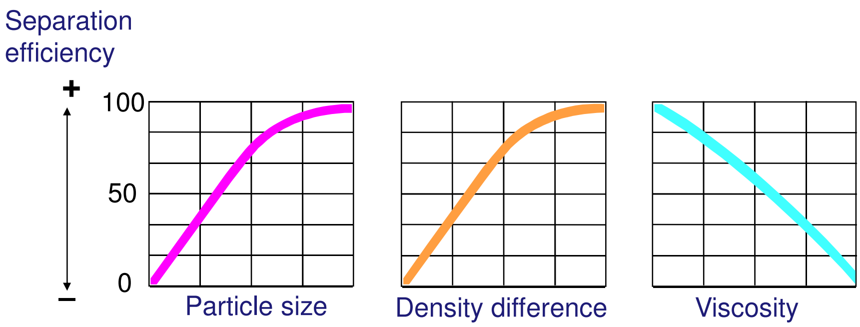


SEPARATION EFFICIENCY

Purifier-Clarifier, Operation in series

for Heavy Fuel oils
Marine & Diesel application

Stokes´ Law and Efficiency



$$V = \frac{d^2(\rho - \rho_2)}{18\eta} c.g$$

SEPARATION EFFICIENCY (%)

for Mineral oils
Marine & Diesel appl.

	Separator	Filter
• Particles < 4 µm	65 - 85	5 - 10
• Cat. fines	60 - 90	~ 5
• Iron	40 - 60	~ 5
• Sodium	40 - 50	< 5

Average from 44 ships during normal operation

Source: Alfa Laval SMT/FA -9402

SEPARATION EFFICIENCY (%)

for Mineral oils
Marine & Diesel appl.

Components in oils not affected by separation

- Density
- Viscosity
- CCAI
- Flash point
- Pour point
- Micro carbon residue
- Sulphur
- Vanadium
- Asphalthenes

Source: Alfa Laval SMT/FA -9402

SEPARATION EFFICIENCY (%)

for Mineral oils
Marine & Diesel appl.

Components in oils Strongly reduced by separation

- Water
- Sodium
- Aluminium Cat. fines
- Silicon Cat. fines
- Iron
- Magnesium

Source: Alfa Laval SMT/FA -9402

SEPARATION EFFICIENCY (%)

for Mineral oils
Marine & Diesel appl.

Water in separator bowl in general:

To achieve the best separation result,

- Water must never enter the disc-stack

SEPARATION EFFICIENCY (%)

for Mineral oils
Marine & Diesel appl.

Conventional separator: The purifier

Purifier optimum interface position: 2

- ***Correct gravity disc size***
- ***Clean Disc-stack***
- ***Maintain following feed conditions:***
  - Constant oil properties = viscosity & density
  - Constant FLOW- rate
  - Constant TEMPERATURE

SEPARATION EFFICIENCY (%)

for Mineral oils
Marine & Diesel appl.

Conventional separator system :

PURIFIER LIMITATIONS

- ***The Gravity Disc***
- ***Maximum Density 991 Kg/m^3***
- ***Manual Adjustment***
- ***Optimum Separation hard to achieve***
- ***Need of qualified attention for optimum result***

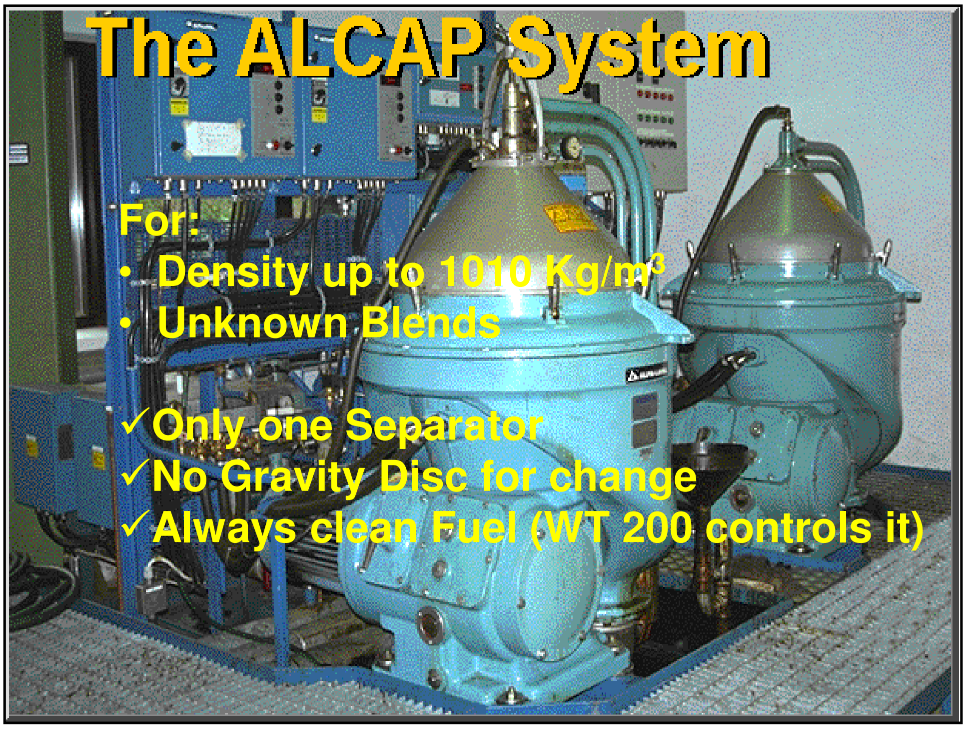
SEPARATION EFFICIENCY (%)

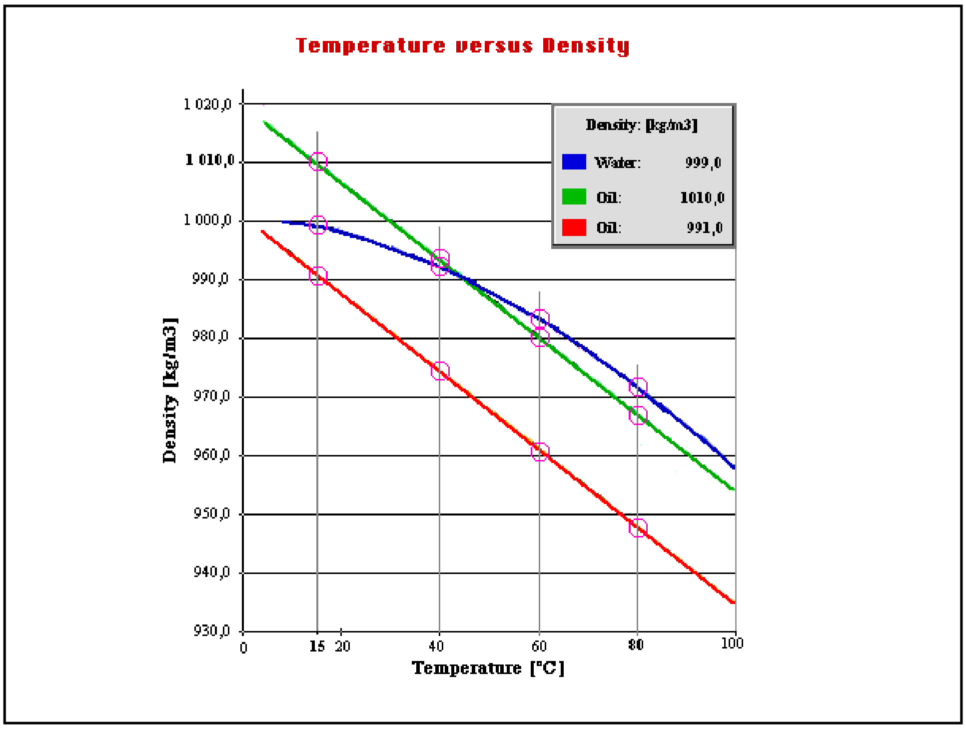
for Mineral oils
Marine & Diesel appl.

Conventional separator system :

OPTIMUM SEPARATION RESULT on HFO

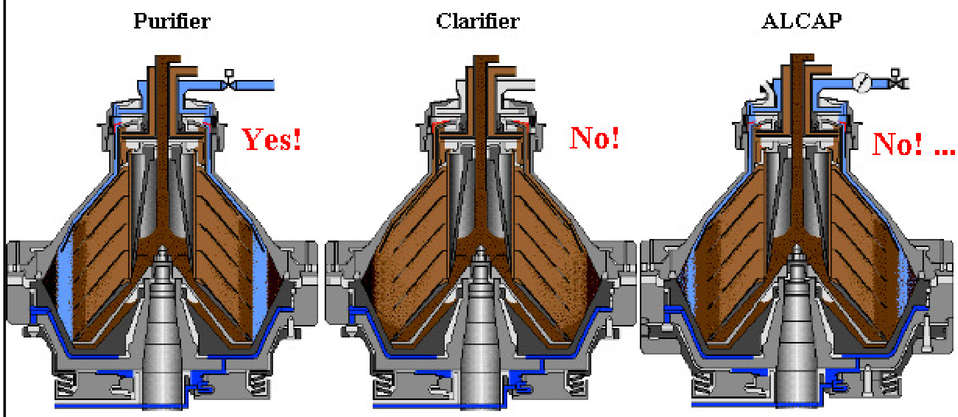
- ***Maximum Density 991 Kg/m^3***
- ***PURIFIER followed by CLARIFIER***
- ***CLARIFIER act as "SAFETY NET" = POLISHER***
- ***CLARIFIER to be discharged at same interval as the preceding purifier***
- ***Operation IN SERIES for optimum result.***

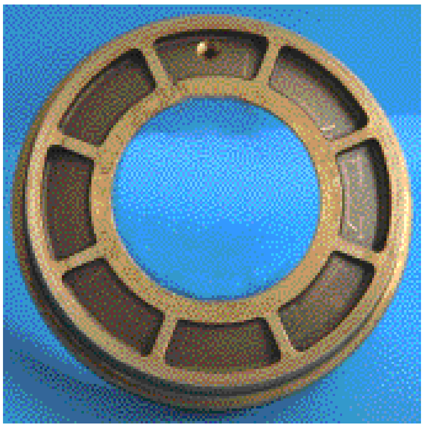

The ALCAP System
For:
• Density up to 1010 Kg/m3
• Unknown Blends
✓Only one Separator
✓No Gravity Disc for change
✓Always clean Fuel (WT 200 controls it)


Temperature versus Density
Density: [kg/m3]
Water: 999,0
Oil: 1010,0
Oil: 991,0
Density [kg/m3]
1 020,0
1 010,0
1 000,0
990,0
980,0
970,0
960,0
950,0
940,0
930,0
0
15
20
40
60
80
100
Temperature [°C]

Similarities and Differences

Water Seal / Interface / Gravity Disc



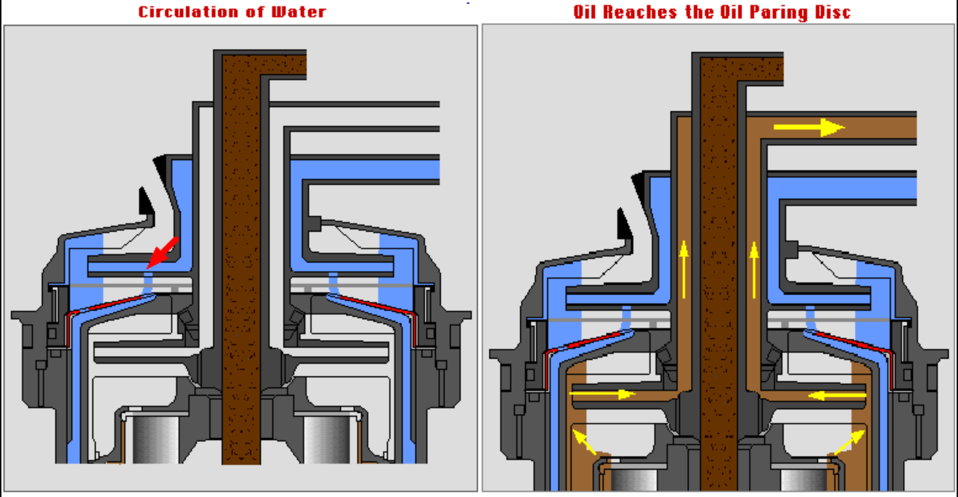


Flow control disc

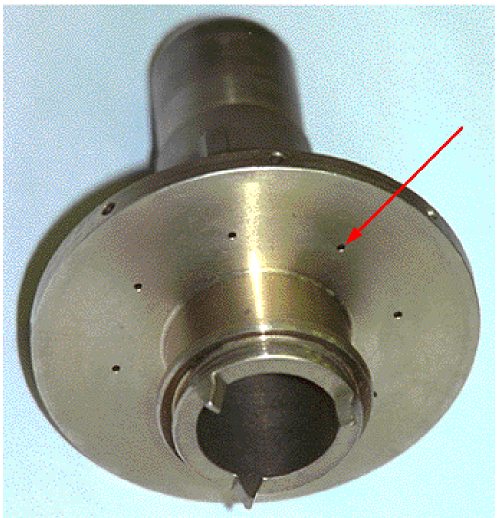
Gravity disc

Circulation of Water

Oil Reaches the Oil Paring Disc

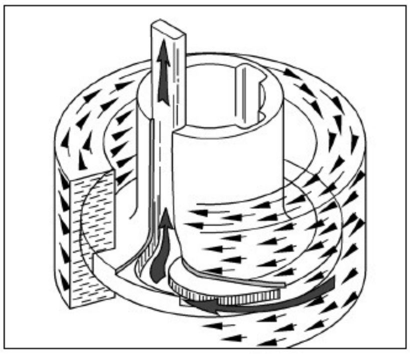


Recirculation Holes in Water Paring Disc



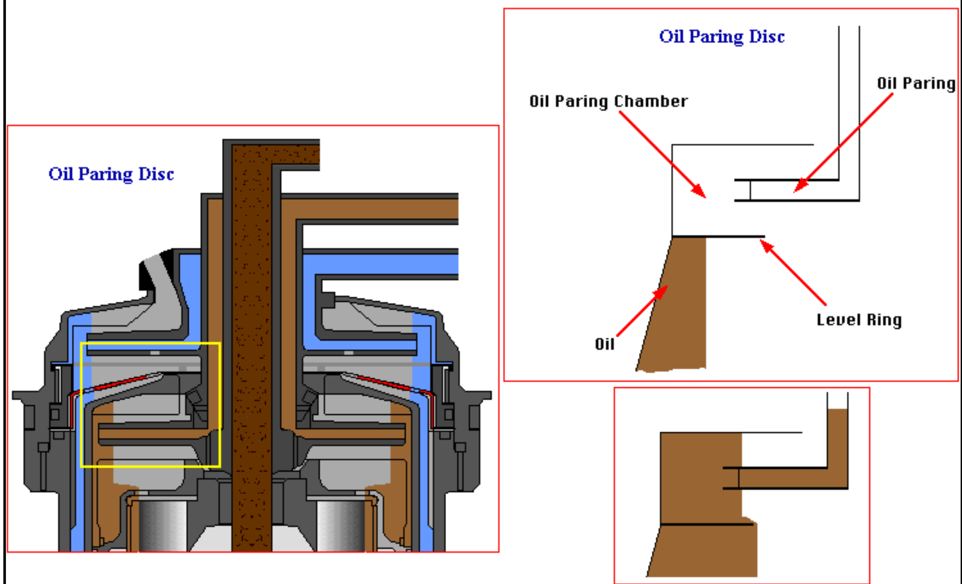
WATER & OIL PARING DISCS

Centripetal pump
- discharges the separated liquid under pressure.
- is firmly connected to bowl hood of the separator.



- The disk provided with channels dips into the liquid rotating with the bowl.
- The liquid
  - is pared off by the centripetal pump and
  - flows through its spiral channels from the outside to the inside.

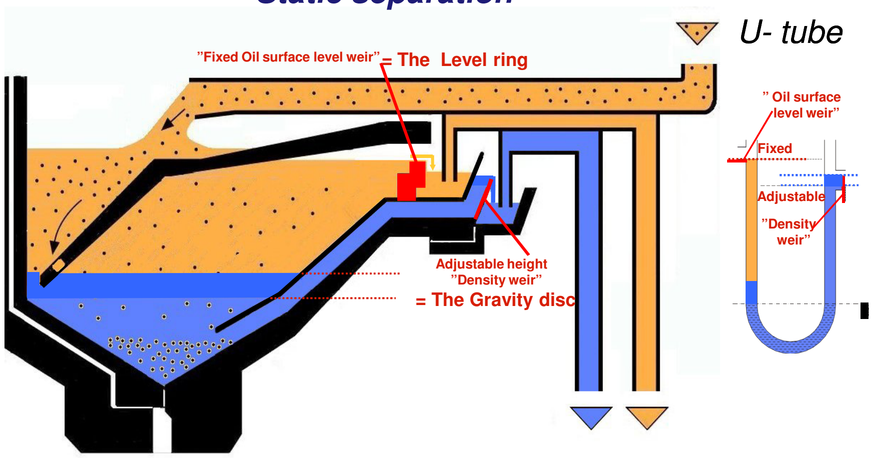
  By this means the kinetic energy is converted into pressure energy which makes possible discharging the liquid under pressure.

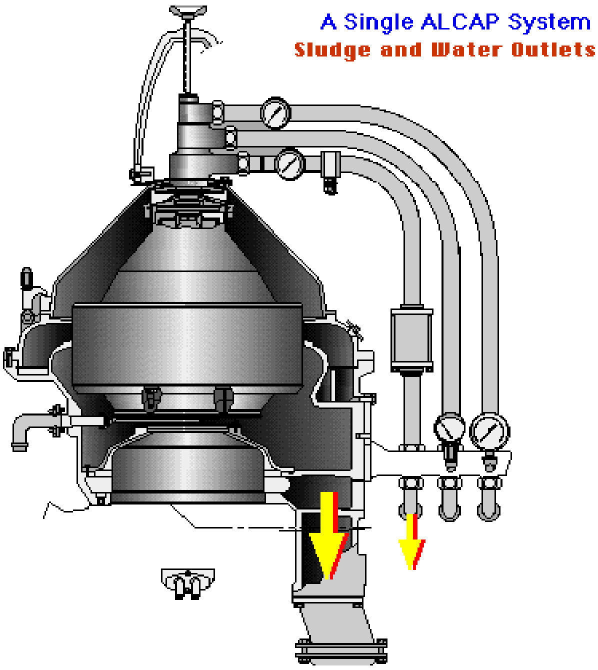


BASIC SEPARATION THEORY

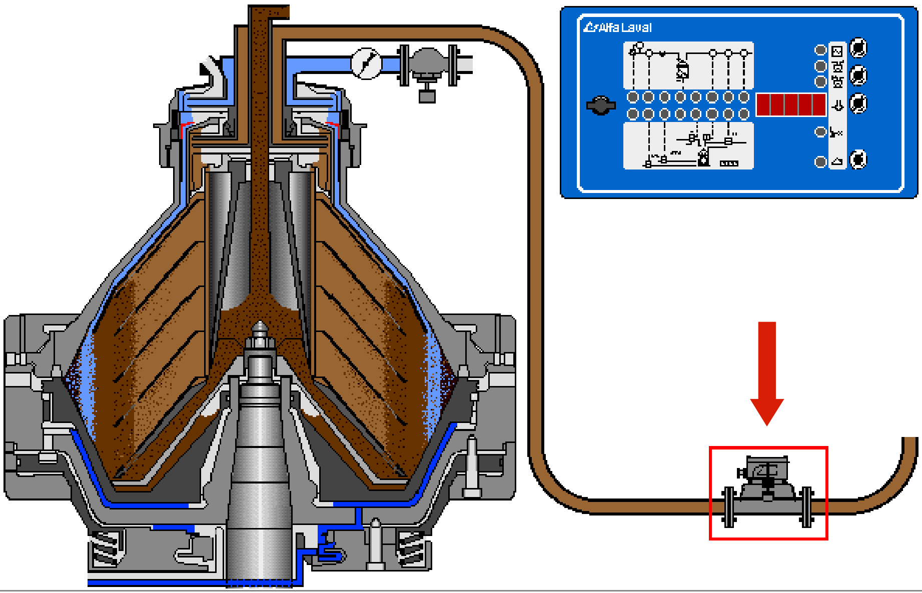
Conventional separator = A tank

- *Static separation*



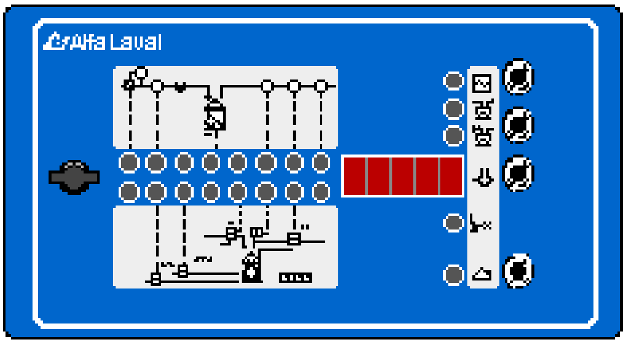


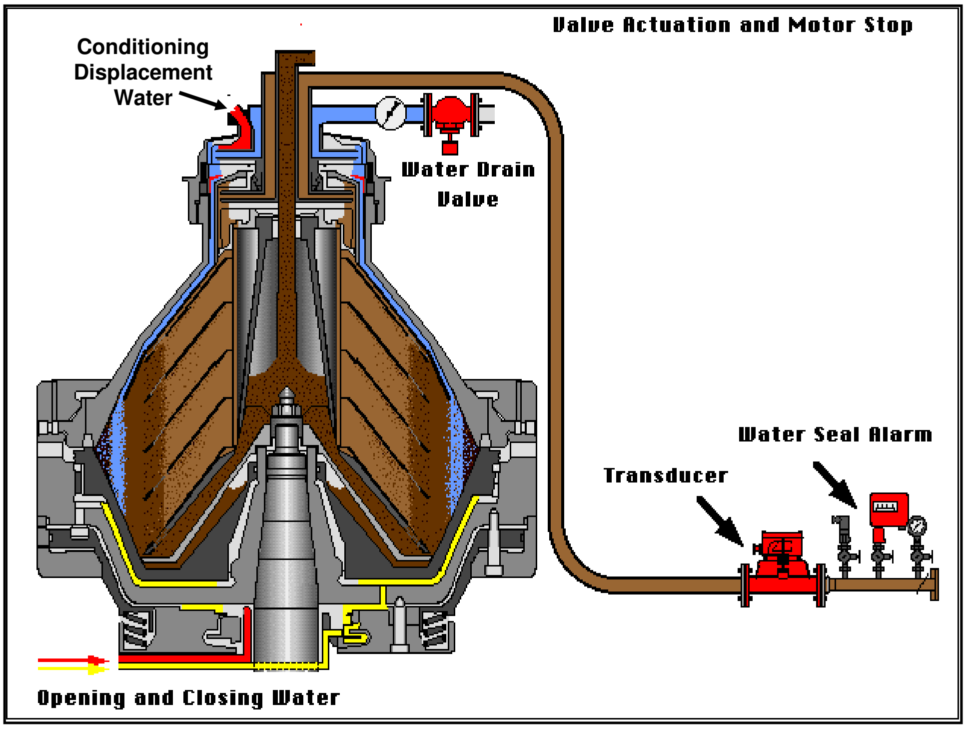
Measuring the Water Content

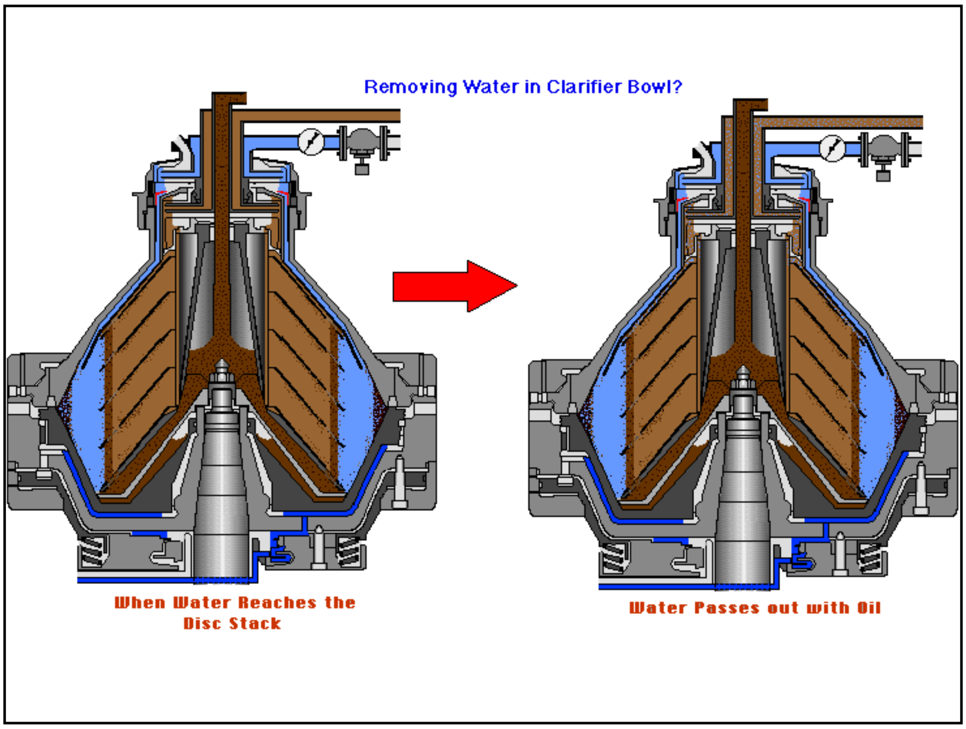


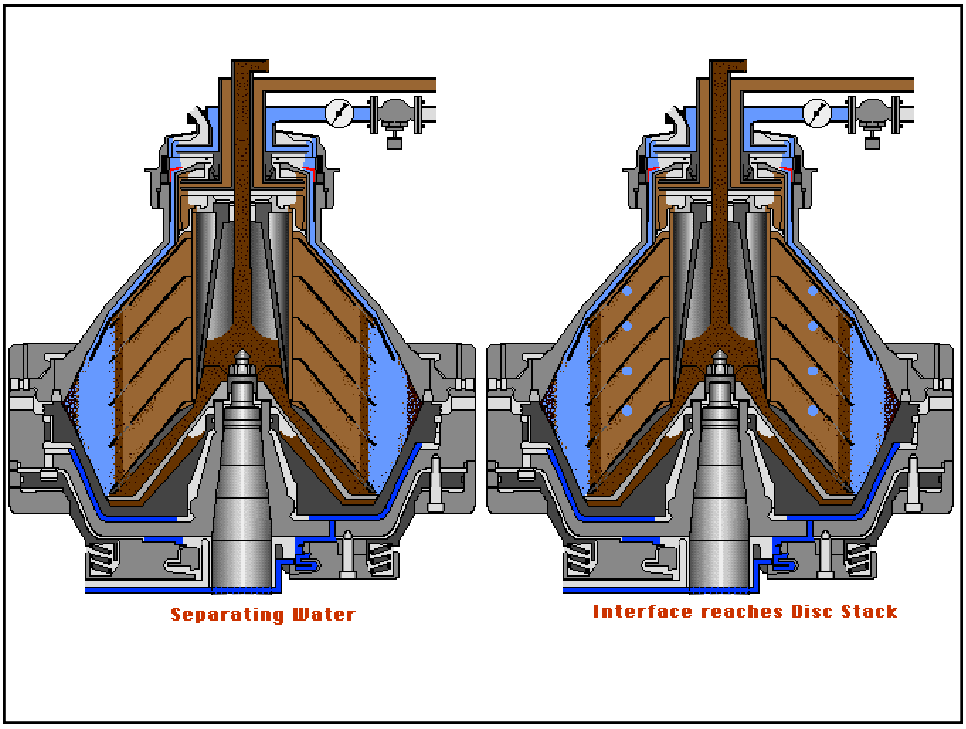
EPC 400

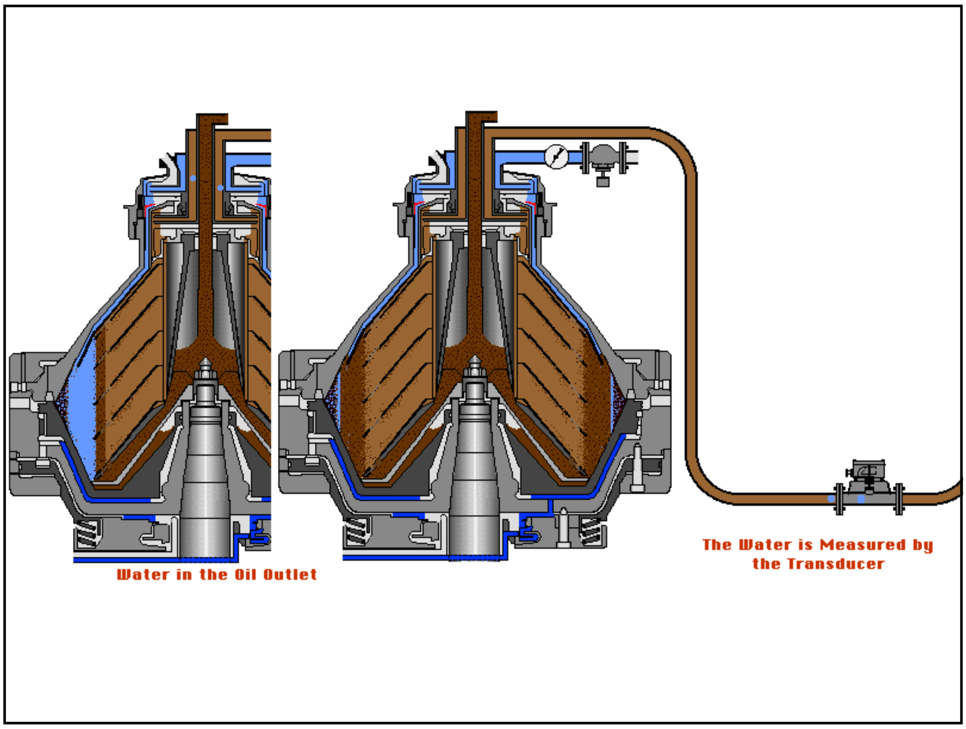
What Has To Be Controlled?

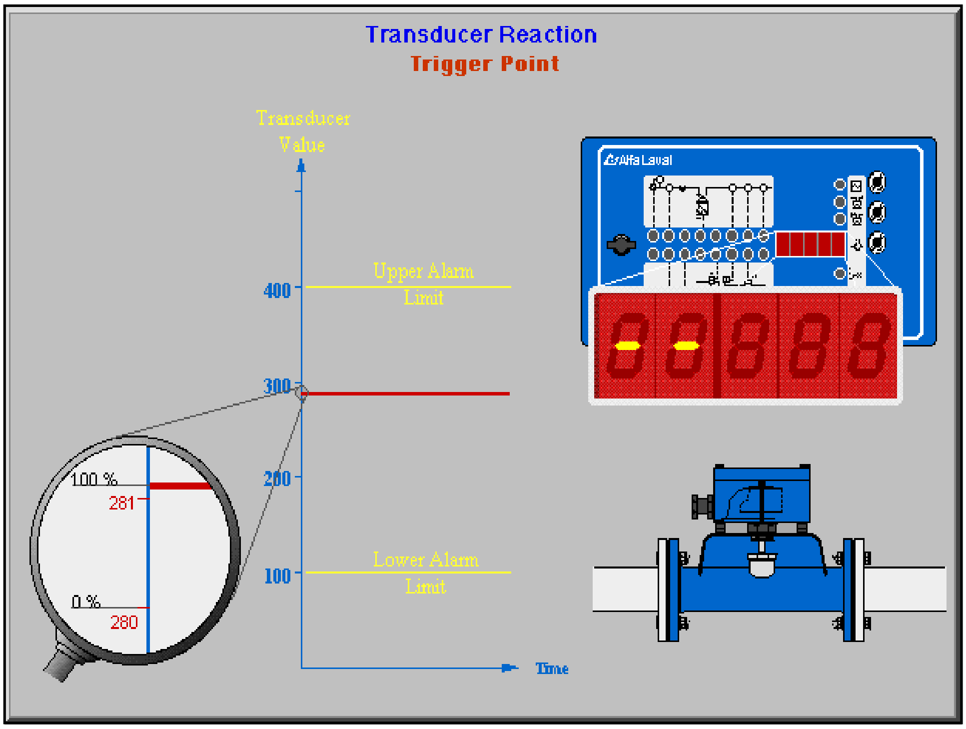


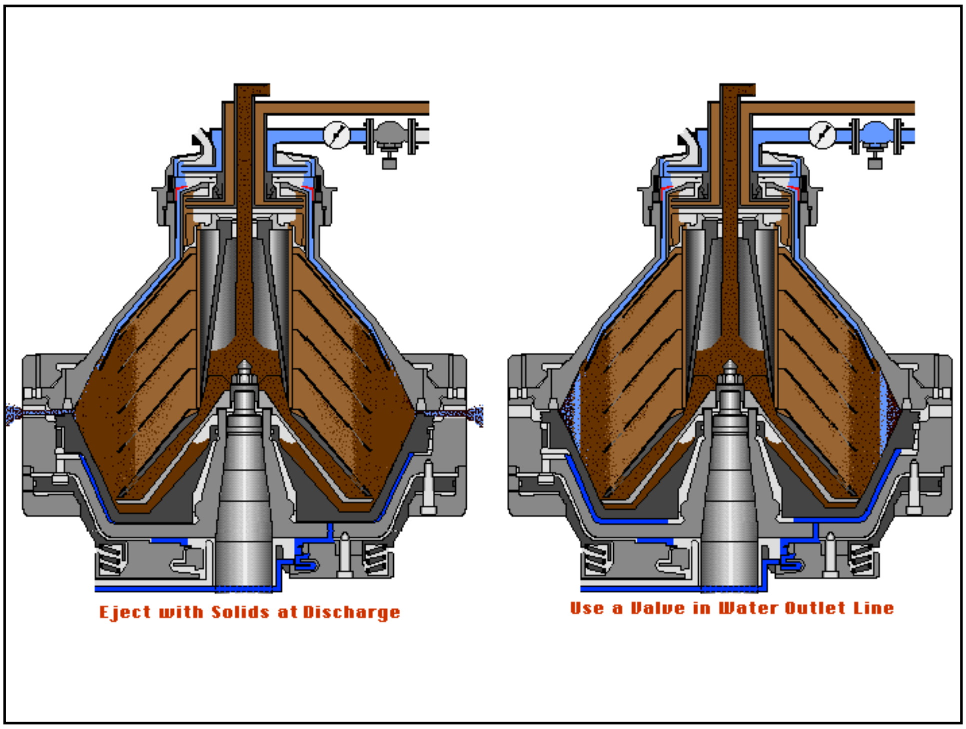

Valve Actuation and Motor Stop
Conditioning Displacement Water
Water Drain Valve
Water Seal Alarm
Transducer
Opening and Closing Water


Removing Water in Clarifier Bowl?
When Water Reaches the Disc Stack
Water Passes out with Oil

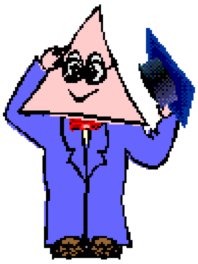

Separating Water
Interface reaches Disc Stack


Water in the Oil Outlet
The Water is Measured by
the Transducer


Transducer Reaction
Trigger Point
Transducer
Value
400
300
200
100
Upper Alarm
Limit
Lower Alarm
Limit
Time
100 %
281
0 %
280
Alfa Laval

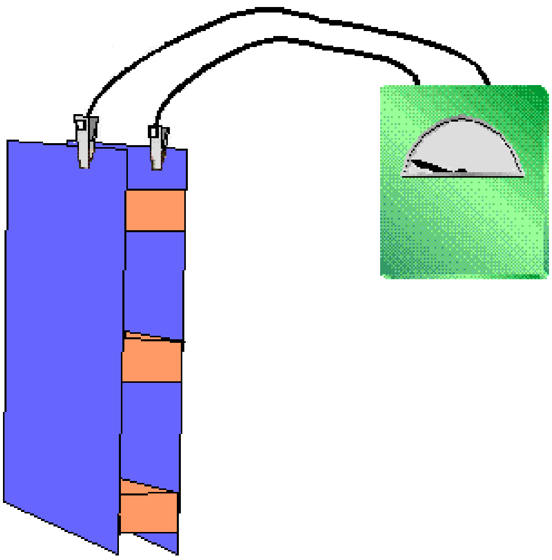

Eject with Solids at Discharge
Use a Valve in Water Outlet Line

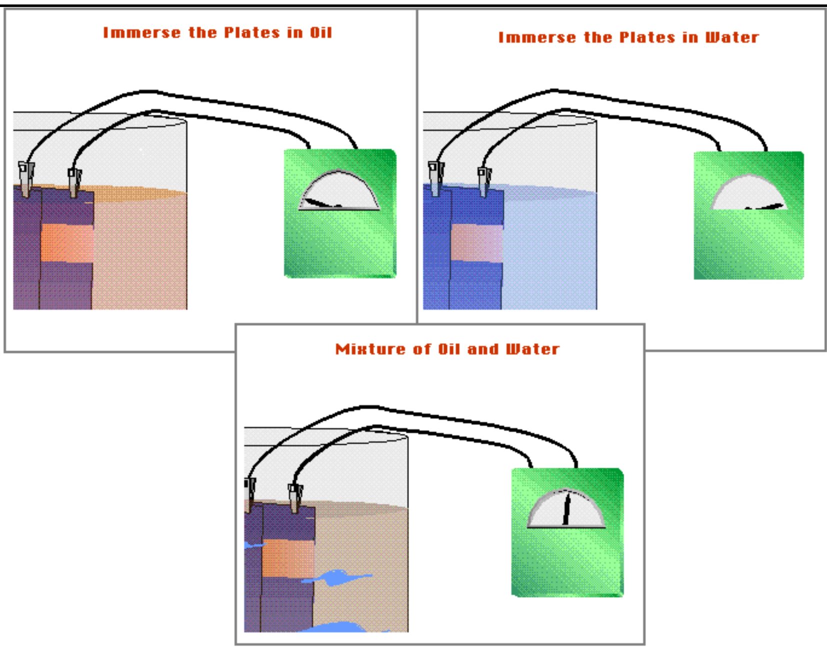
What is capacitance and how can we use it for our purpose ?



The Capacitor

Electrical Circuit





$$C = \frac{\varepsilon_0 \varepsilon_r A}{d}$$

C = Capacitance in Farads F

ε_o = Permativity in free space (vacuum) 8.854×10^{-12} F/m

ε_r = The Relative Permativity of the substance between the plates.

A = The area of the plates in m^2

d = The plate separation in meters.

Dielectric Constant

Dielectric Constants ε_r at 20°C

Dry Air	1.006 (take as 1)
Petrol	2
Paraffin/ Gas oil	2,2
Lub. /fuel oil	2 to 3
Waxed paper	2 to 3
Plastics	2 to 4
Mica	4 to 7
Resins	3 to 6
Rubber	2 to 6
Glass	5 to 10
Glycerine	56
Water (pure distilled)	80

$$C = \frac{\varepsilon_r \varepsilon_0 A}{d}$$

C = Capacitance in Farads F

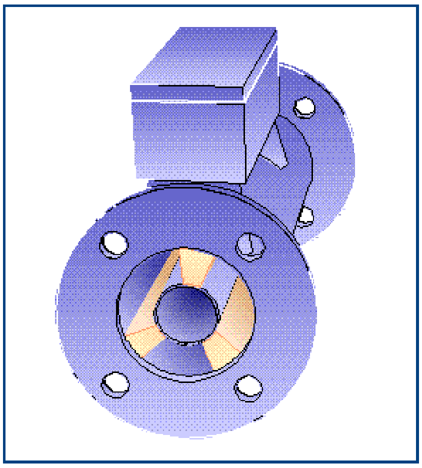
ε_0 = Permativity in free space (vacuum) 8.854×10^{-12} F/m

ε_r = The Relative Permativity of the substance between the plates.

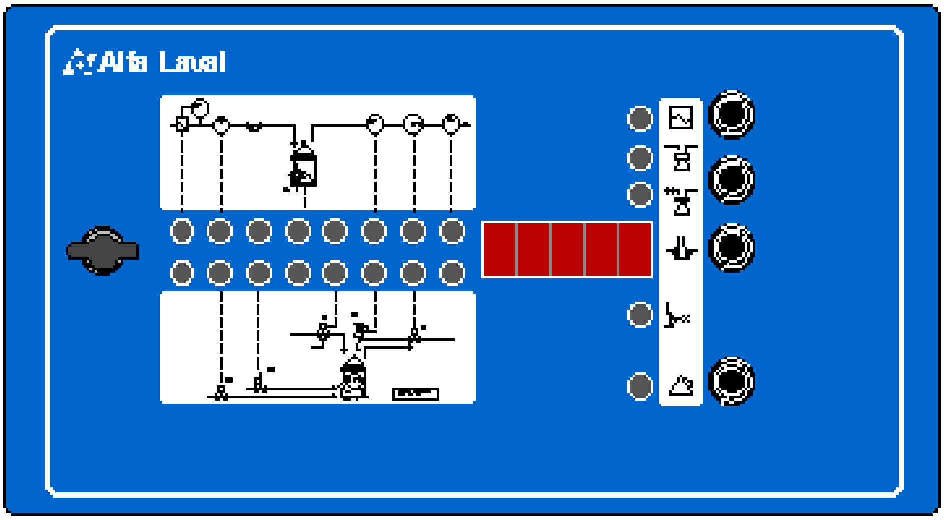
A = The area of the plates in m^2

d = The plate separation in meters.

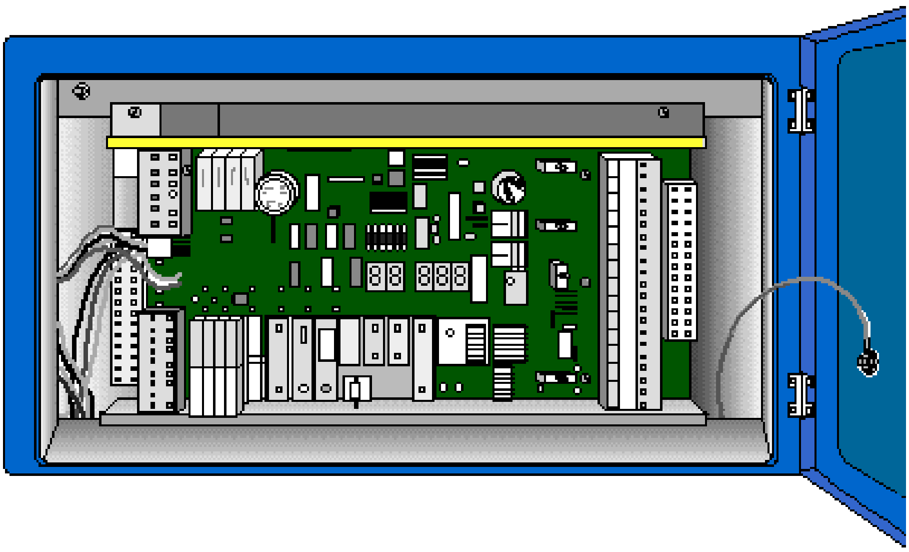
The Transducer



The EPC 400, Front Panel

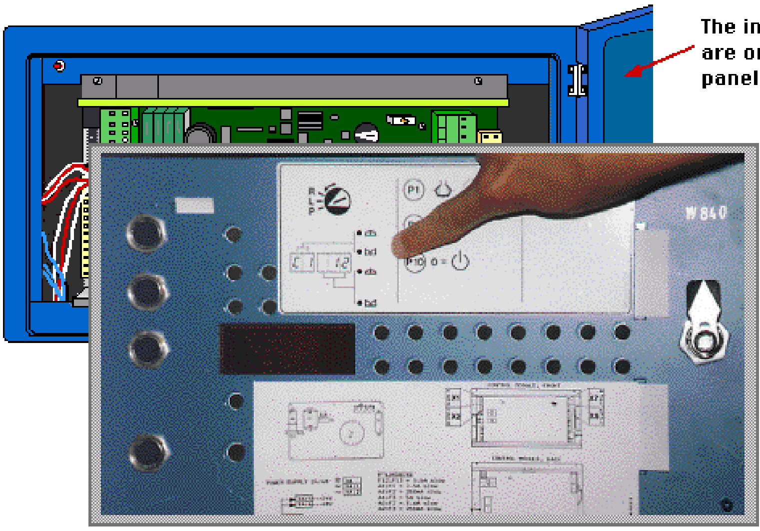


The EPC 400, Printed Circuit Board



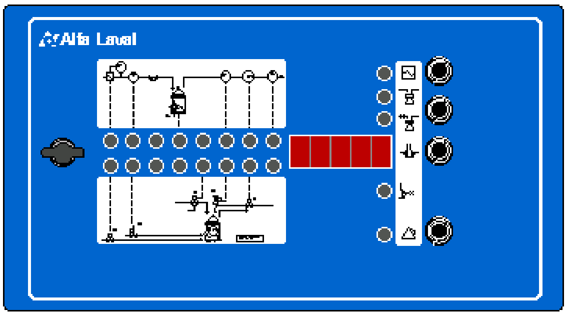
PARAMETERS

The EPC 400, Printed Circuit Board
Information Labels



The information labels are on the inside of the panel door.

Parameter Groups



The parameters are divided in two groups. Each group with an access code;

Group C1	Process Parameters	1 - 19
Group C2	Installation Parameters	20 - 49
	Timer Sequence Parameters	50 - 89
	Service Mode parameters	90 - 99

The process, installation and timer sequence parameter settings are similar and are described together.

Parameter		Description or unit	Range	Factory set value	Plant set value
P1[1]	Max. time between sludge discharges	Minutes P1 = P60 + P61 Changing of P1 automatically changes P61.	0 – 999	30	.....
P2[1]	Clarifier mode		C	C	
P3 P4	Not in use			- - -	
P5[1]	High temperature alarm	°C or °F	0 – 115 °C or 0 – 255 °F	0	.....
P6[1]	Low temperature alarm	°C or °F	0 – 115 °C or 0 – 255 °F	- - -	.....
P7[1]	Temperature set point	°C or °F	0 – 110 °C or 0 – 240 °F	- - -	.....
P8[1]	P-band	%	10 – 500	- - -	.....
P9[1]	I -time	Minutes	0.1 – 10.0	- - -	.....
P10[1]	Stand-by/On mode	0 = Stand-by 1 = On P10 = 0 must only be used during test operation.	0 or 1	1	.....
P11 to P14	Not in use			- - -	
P15[1]	HFO / do selection of type of oil	HFO = Heavy Fuel Oil do = diesel oil	HFO or do	HFO	.....
P16 to P19	Not in use			- - -	

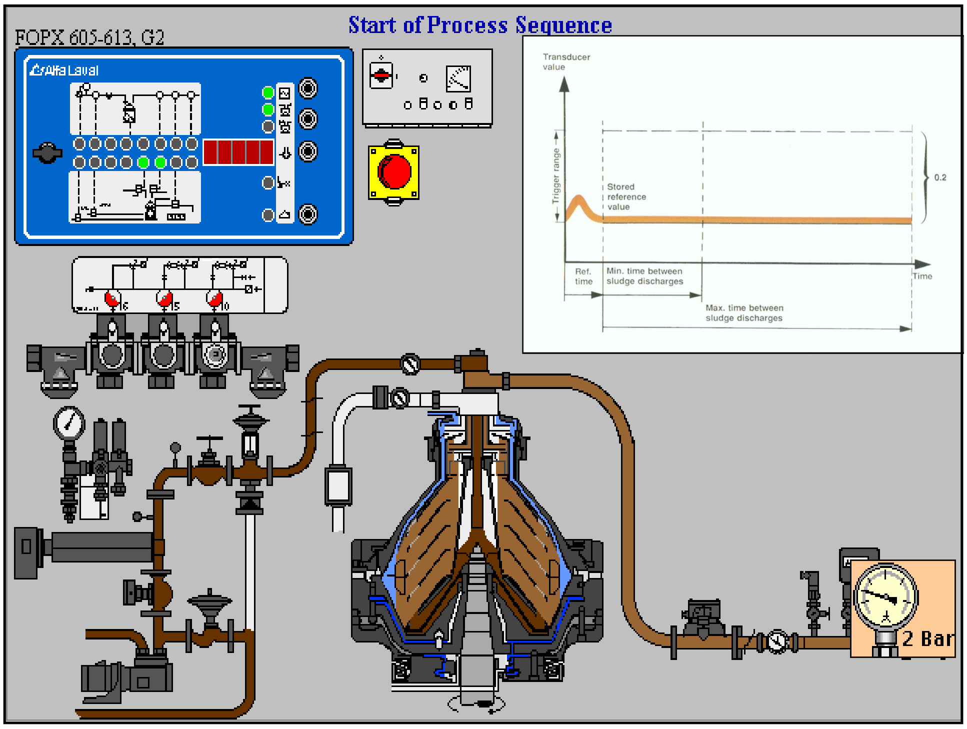
Parameter		Description or unit	Range	Factory set value	Plant set value
P20	Separator type	4.1 = FOPX 605/609/610/613 4.3 = FOPX 611	4.1 – 5.2	4.1	4.1 or 4.3
P21	Power frequency	Hz Check that the frequency is correct, see label on the separator.	50 or 60	50	.....
P22	Not in use			- - -	
P23[1]	EPC-400 address	1 = EPC-400 2-8 = Not in use	1 – 8	1	1
P24 to P32	Not in use			- - -	
P33	Emergency stop function	0 = Emergency stop only 1 = Mechanical vibration switch	0 or 1	0	.....
P34[1]	Alarm delay time	Seconds	1 – 30	15	.....
P35[1]	Low temperature alarm delay after MV1 change over	Seconds	1 – 999	15	.....

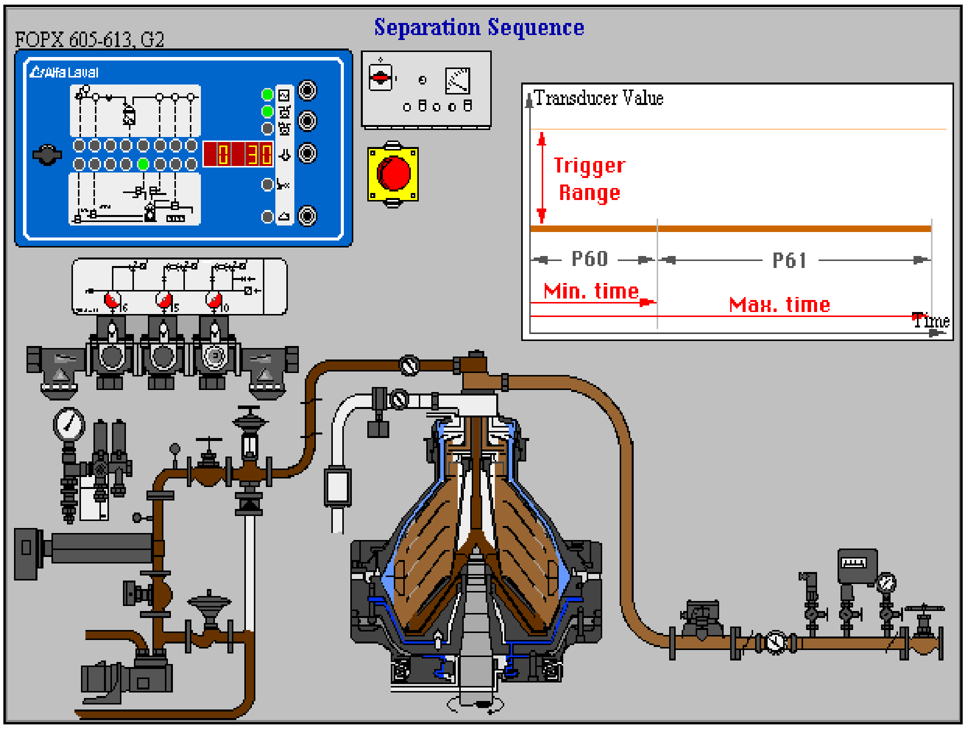
Parameter		Description or unit	Range	Factory set value	Plant set value
P36[1]	Remote control	0 = No remote control 1 = Remote switches 2 = Remote computer 3 = Remote control unit 10 = No remote control, alarm A4-1 cancelled 11 = Remote switch, alarm A4-1 cancelled 12 = Remote computer, alarm A4-1 cancelled 13 = Remote control unit, alarm A4-1 cancelled	0 – 3, 10 – 13	0	.....
P37[1]	Heater type	0 = No or common heater with separate controller 1 = Heatpac EHS-62 controlled by EPC-400 2 = Heater with control valve, controlled by EPC-400	0 – 2	0	.....
P38	Size of Heatpac heater	kW If P37 = 1 then P38 is set to 16, otherwise P38 = "- - -".	0, 7, 8, 14, 16, 22, 24, 36, 40, 50, 56, 65, 72	- - -	.....
P39	Run time of control valve	Seconds If P37 = 2 then P39 is set to 120, otherwise P39 = "- - -".	0 – 999	- - -	.....
P40[1]	Temperature reading	C = °C F = °F	C or F	C	.....
P41[1]	Max. start time for heater	Minutes	0 – 999	15	.....
P42	Not in use			- - -	
P43[1]	Extra alarm function	0 = Alarm indication on display. No action. 1 = Alarm indication on display. Oil feed off during separation sequence.	0 – 1	0	.....
P44 to P49	Not in use			- - -	

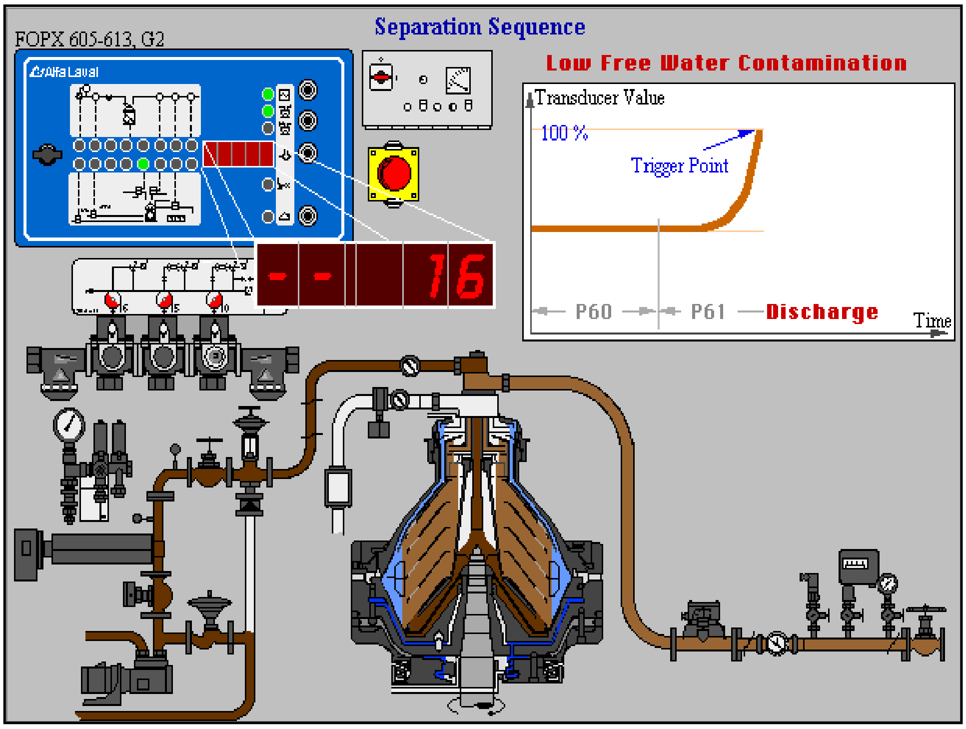
Parameter		Description or unit	Range	Factory set value	Plant set value
Starting sequence					
P50[1]	Bowl closing water	Seconds	0 – 999	15	.....
P51	Not in use			- - -	
P52[1]	Reference time, oil feed on	Seconds	0 – 999	120	.....
P53[1]	Conditioning water	Seconds	0 – 999	60	.....
P54 to P59	Not in use			- - -	
Separation sequence					
P60[1]	Time to first discharge after start-up (for calibration)	Minutes	0 – 999	10	.....
P61[1]	Time between sludge discharges	Minutes P60 + P61 = P1 Changing of P1 automatically changes P61.	0 – 999	20	.....
P62 to P69	Not in use			- - -	

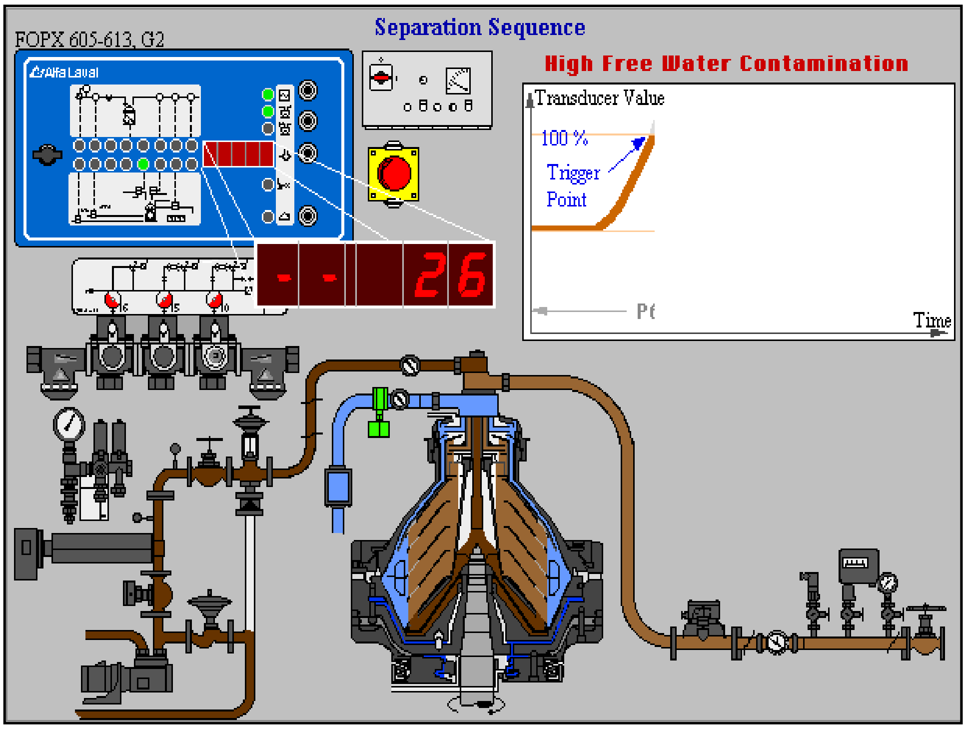
Parameter		Description or unit	Range	Factory set value	Plant set value
Sludge discharge sequence					
P70[1]	Displacement water	Seconds	0 – 999	120	.....
P71	Not in use			- - -	
P72[1]	Sludge discharge	Seconds	0 – 99.9	3.0	.....
P73	Not in use			- - -	
P74[1]	Bowl closing water	Seconds **N.B.** This parameter is only valid for FOPX 611.	0 – 999	6	.....
P75	Not in use			- - -	
P76[1]	Reference time	Seconds	0 – 999	30	.....
P77	Not in use			- - -	
P78[1]	Conditioning water	Seconds	0 – 999	25	.....
P79	Not in use			- - -	
Stopping sequence					
P80 to P83	Not in use			- - -	
P84[1]	Displacement water. Oil feed off	Seconds	0 – 999	70	.....
P85	Not in use			- - -	
P86[1]	Separator motor off	Seconds	0 – 999	180	.....
P87 to P89	Not in use			- - -	

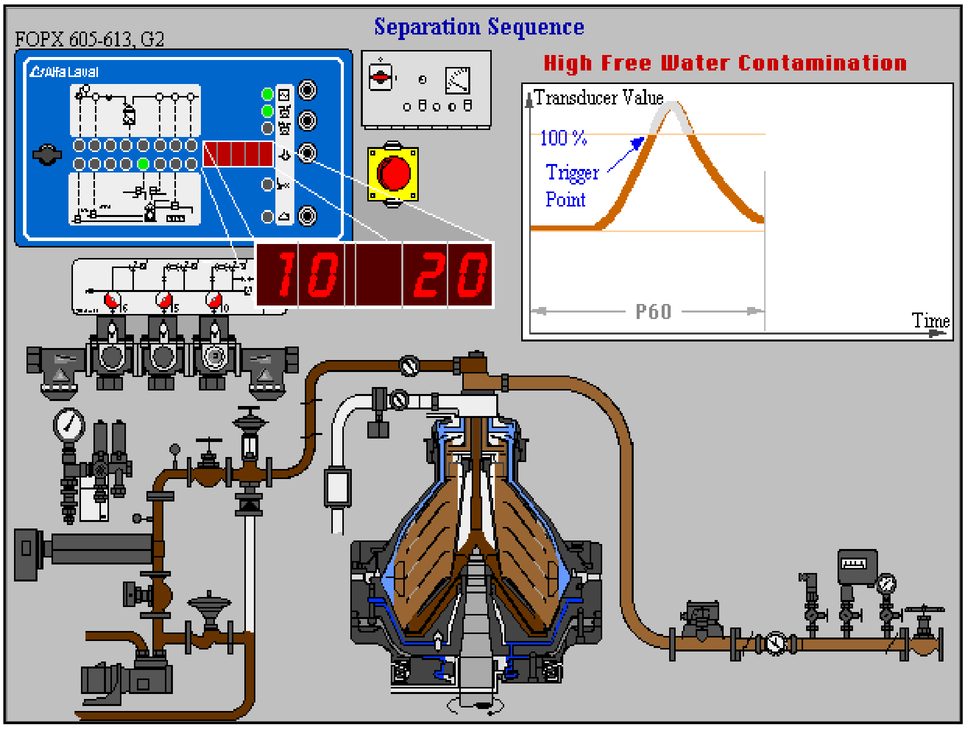
Parameter		Description or unit	Range	Factory set value	Plant set value
P90	Service mode	0 = No service mode 1 = Countdown of timers P50 – P89 50 = Alarm log, including self resetting alarms	0, 1, 50	0	.....
P91 to P99	Not in use			- - -	

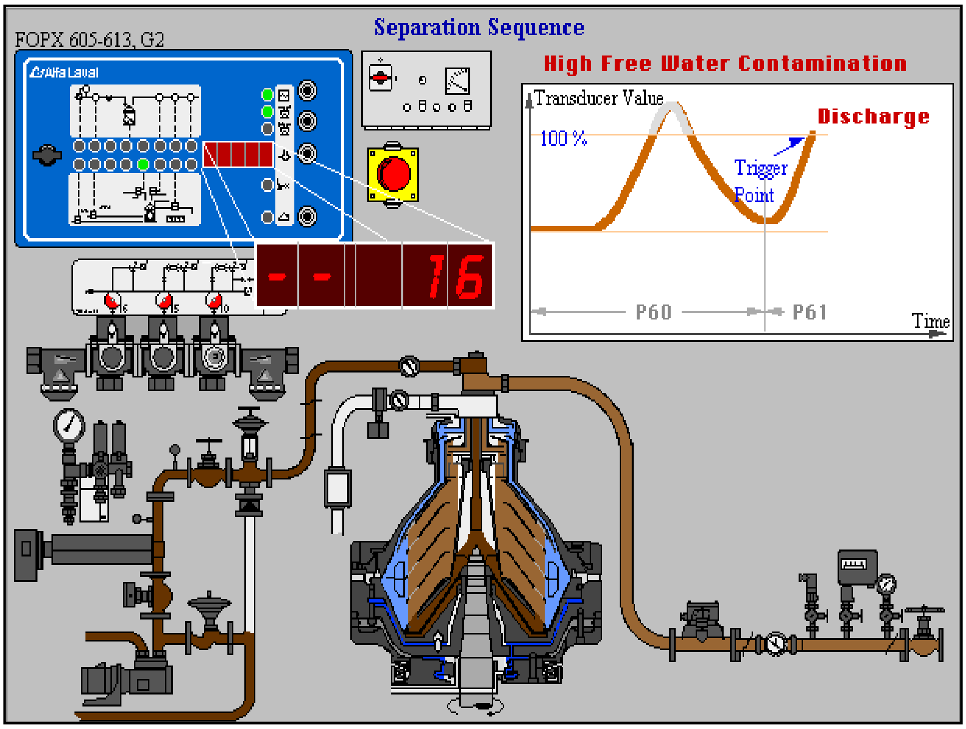

FOPX 605-613, G2
Start of Process Sequence
Alfa Laval
Transducer value
Trigger range
Stored reference value
0.2
Ref. time
Min. time between sludge discharges
Max. time between sludge discharges
Time
2 Bar

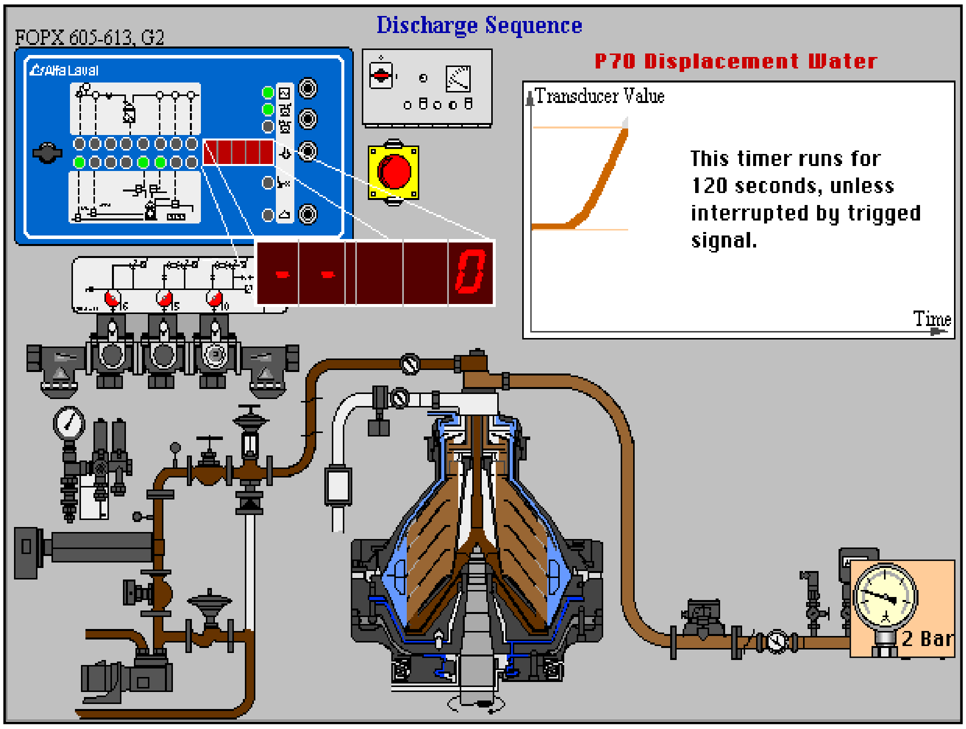

FOPX 605-613, G2
Separation Sequence
Alfa Laval
Transducer Value
Trigger Range
P60
P61
Min. time
Max. time
Time

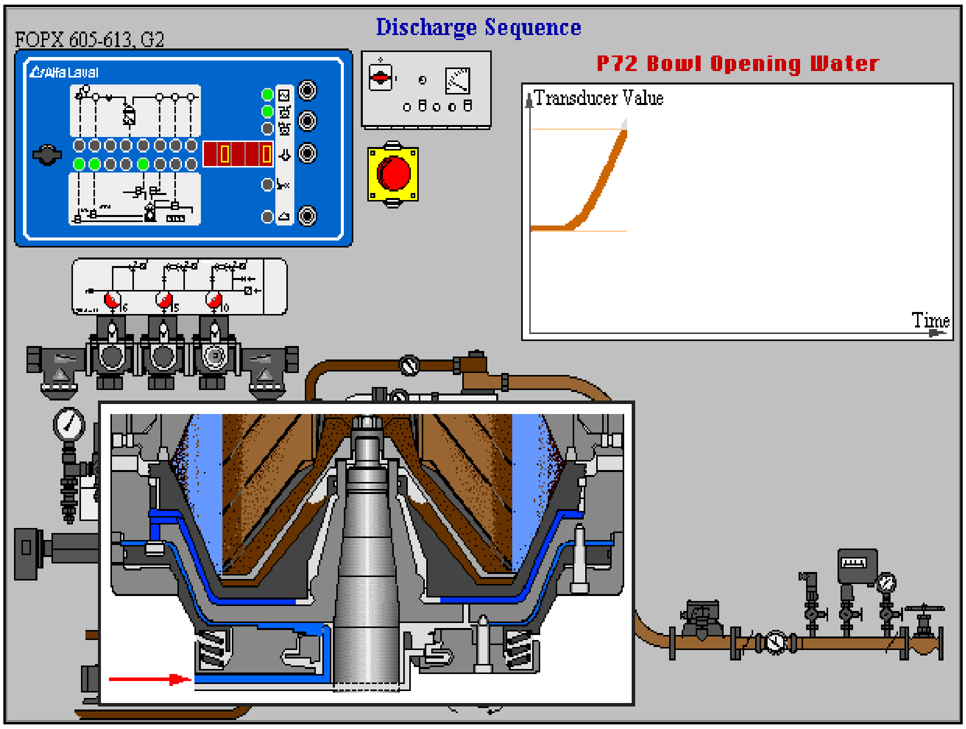

FOPX 605-613, G2
Separation Sequence
Low Free Water Contamination
Transducer Value
100 %
Trigger Point
P60
P61
Discharge
Time
- - 16

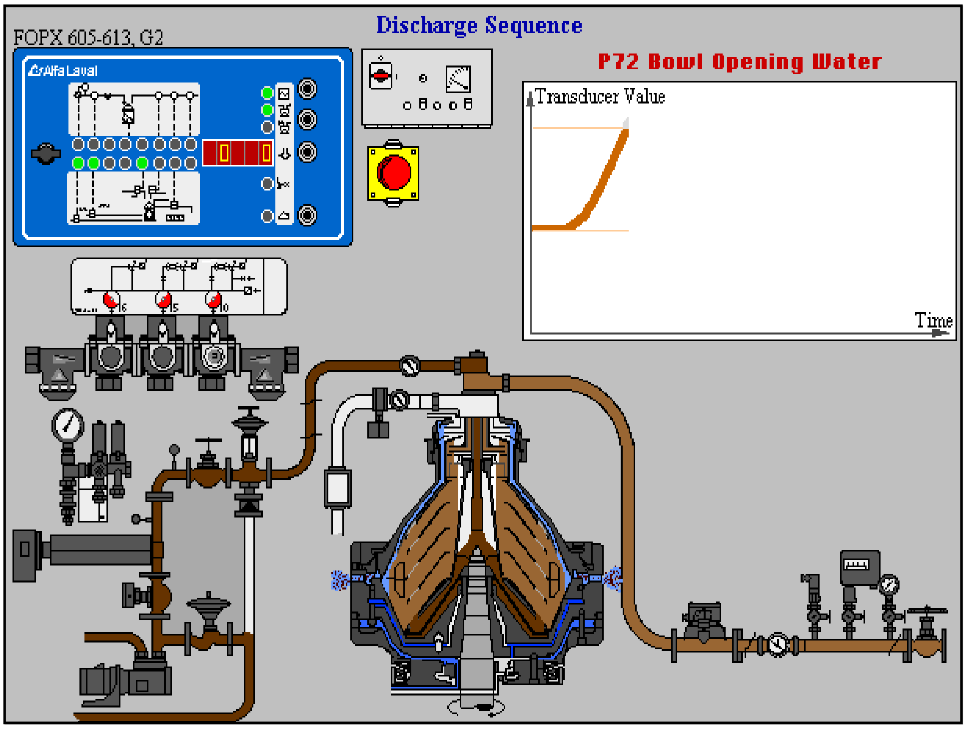

FOPX 605-613, G2
Separation Sequence
High Free Water Contamination
Transducer Value
100 %
Trigger
Point
Time
- - 26

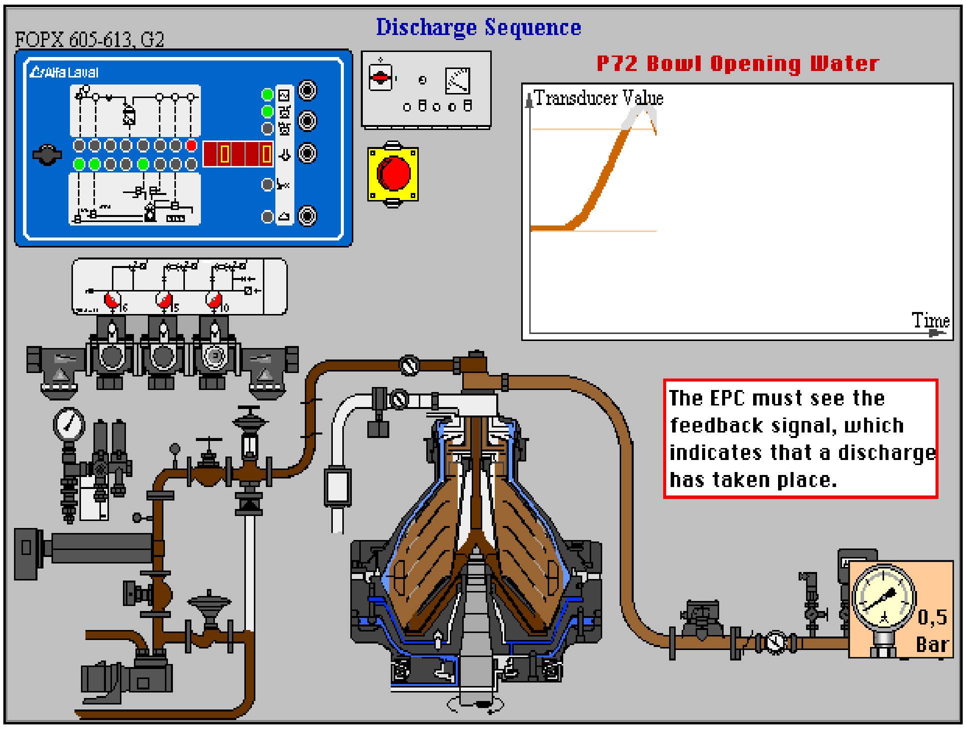

FOPX 605-613, G2
Separation Sequence
High Free Water Contamination
Transducer Value
100 %
Trigger
Point
P60
Time
10 20

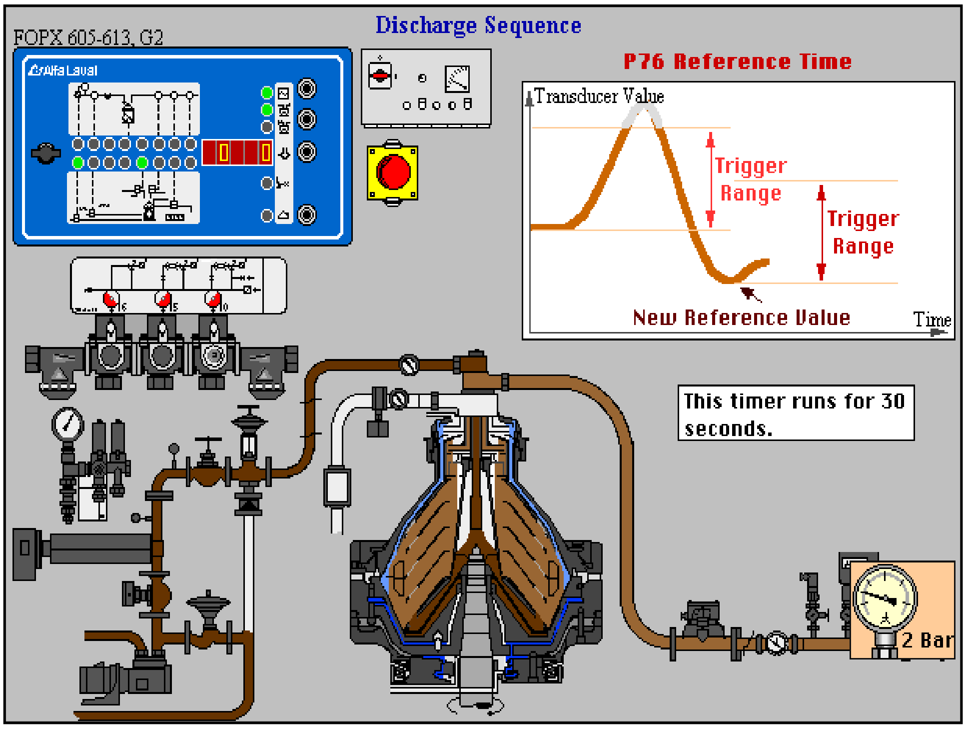

FOPX 605-613, G2
Separation Sequence
High Free Water Contamination
Transducer Value
Discharge
100 %
Trigger
Point
P60
P61
Time
- - 16


FOPX 605-613, G2
Discharge Sequence
P70 Displacement Water
Transducer Value
This timer runs for
120 seconds, unless
interrupted by trigged
signal.
Time
2 Bar

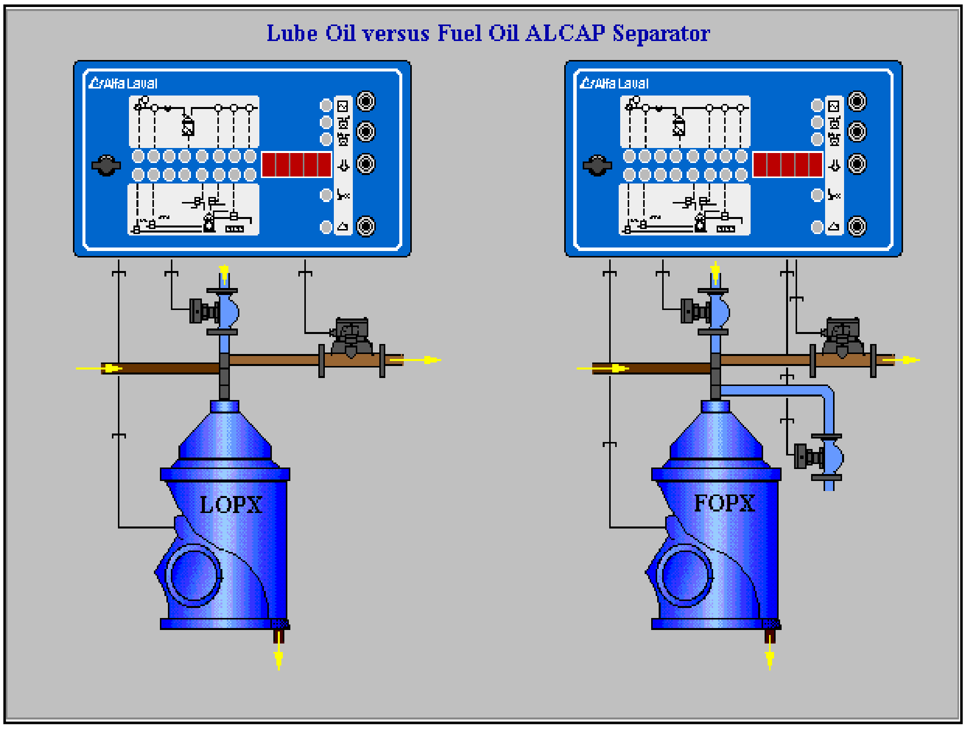

FOPX 605-613, G2
Discharge Sequence
P72 Bowl Opening Water
Transducer Value
Time

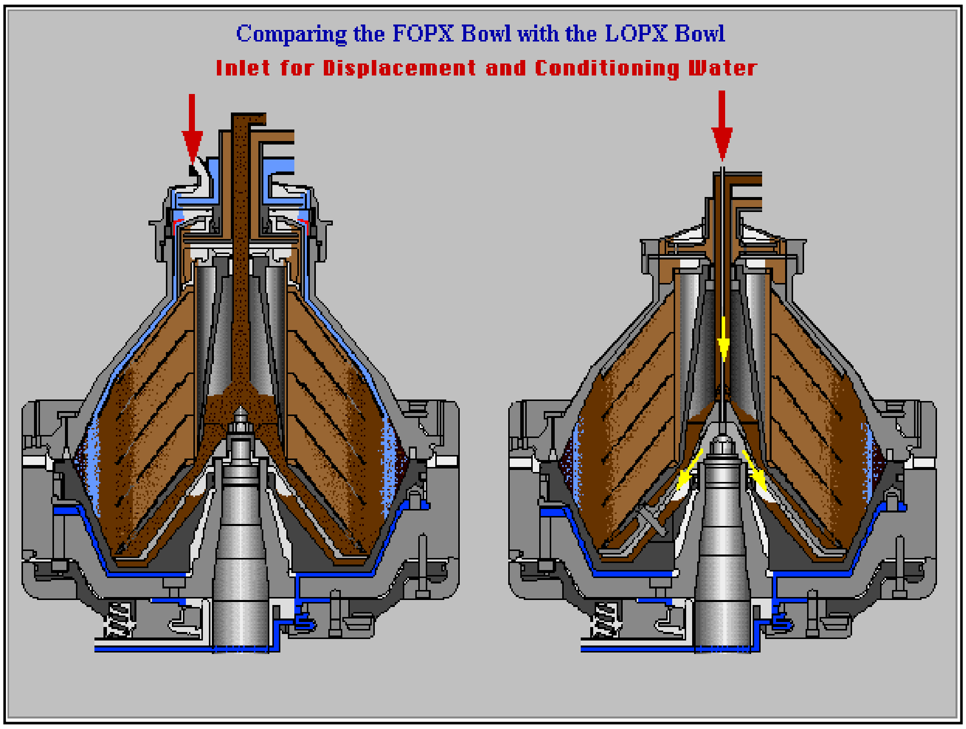

FOPX 605-613, G2
Discharge Sequence
P72 Bowl Opening Water
Transducer Value
Time

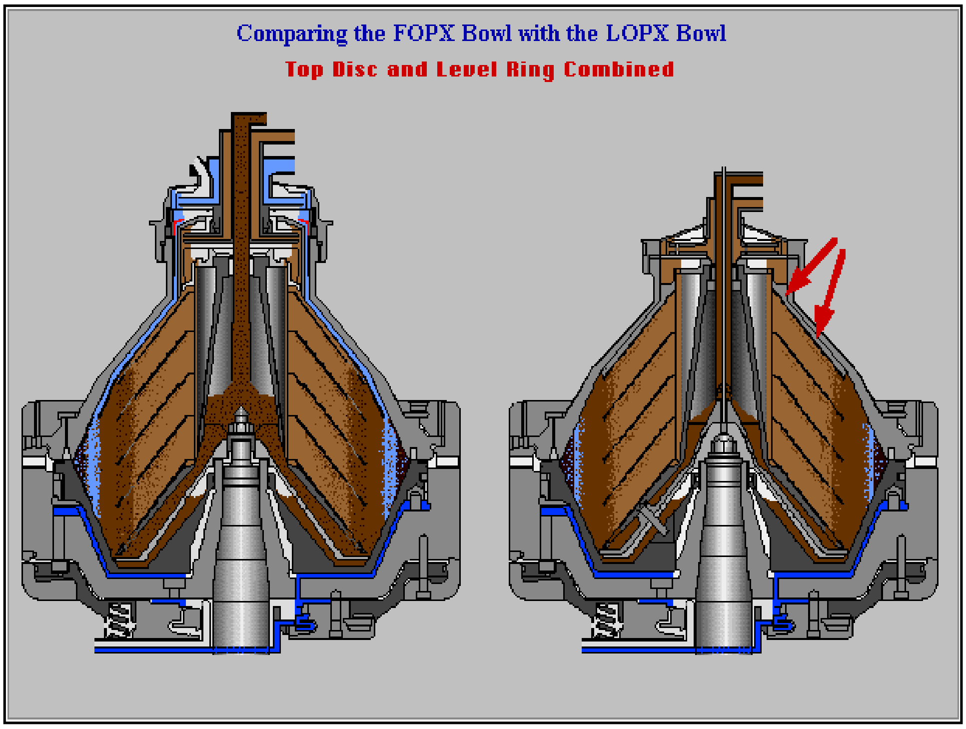

FOPX 605-613, G2
Discharge Sequence
P72 Bowl Opening Water
Transducer Value
Time
The EPC must see the feedback signal, which indicates that a discharge has taken place.
0,5
Bar

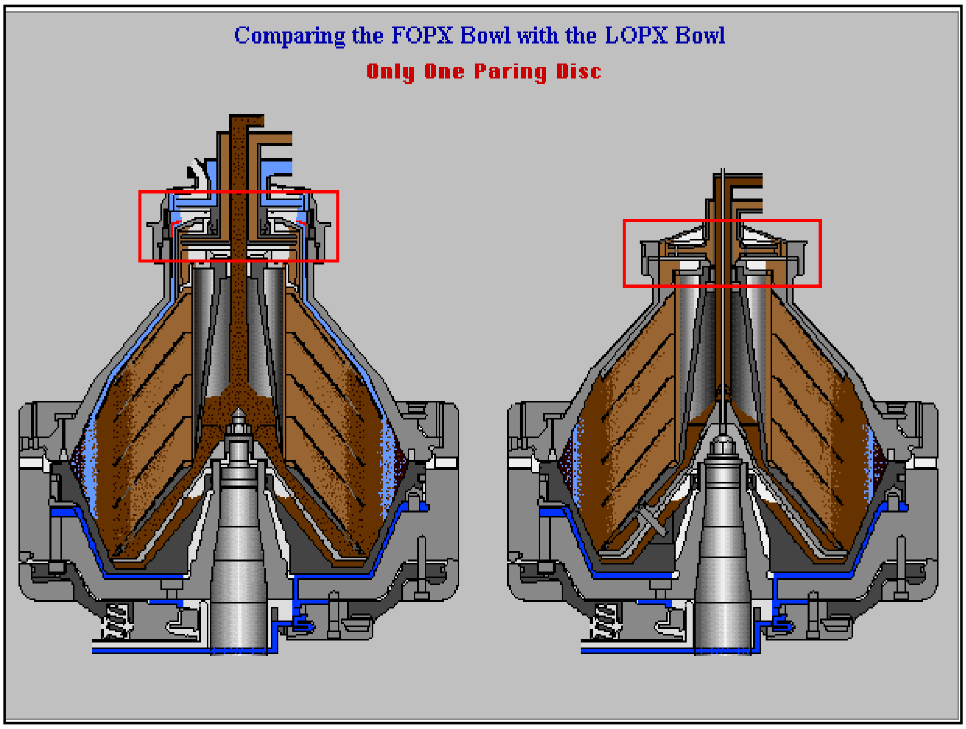

Discharge Sequence
FOPX 605-613, G2
Alfa Laval
P76 Reference Time
Transducer Value
Trigger Range
Trigger Range
New Reference Value
Time
This timer runs for 30 seconds.
2 Bar

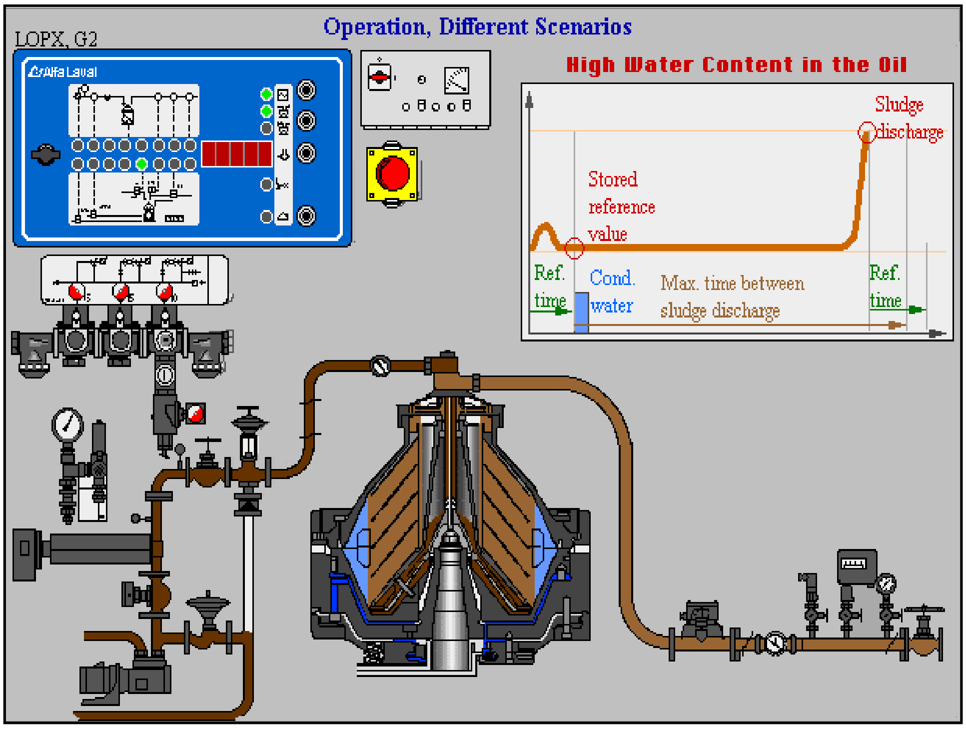

ALCAP Lubricating
Oil Cleaning System


Lube Oil versus Fuel Oil ALCAP Separator
Alfa Laval
Alfa Laval
LOPX
FOPX


Comparing the FOPX Bowl with the LOPX Bowl
Inlet for Displacement and Conditioning Water


Comparing the FOPX Bowl with the LOPX Bowl
Top Disc and Level Ring Combined

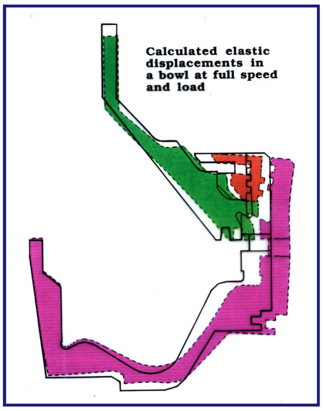

Comparing the FOPX Bowl with the LOPX Bowl
Only One Paring Disc

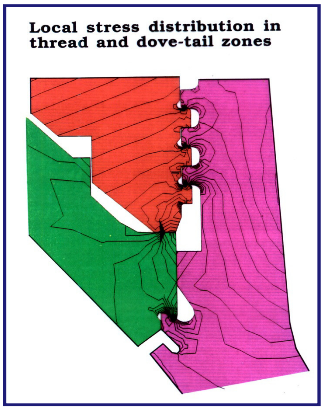


Safety First

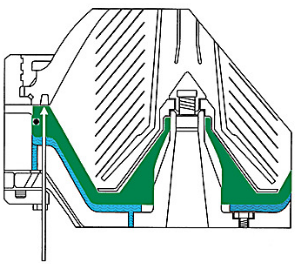
Centrifugal force
Stress

Extreme forces from rotation and process media



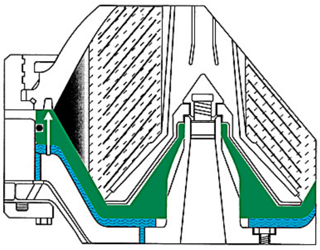


Safety - bowl operation



- Closed but empty bowl
- Sealing force against bowl hood & lock ring 465 kN equal to 47 tons
- For this reason AL seal rings are specially made to withstand these forces

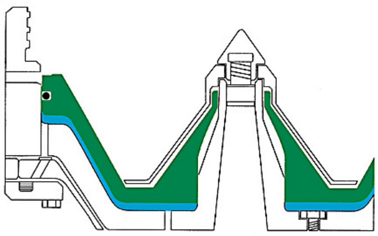
Safety - bowl operation



- Closed and liquid filled bowl
- Sealing force 125 kN equivalent to 13 tons
- AL seal rings are made to withstand the high operating temperatures in the bowl

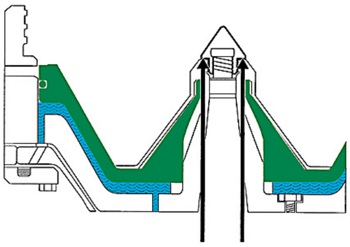
Safety - bowl operation

- Bowl assembled to cap nut, with no closing water on
- No bowl parts fitted
- No axial forces



Safety - bowl operation

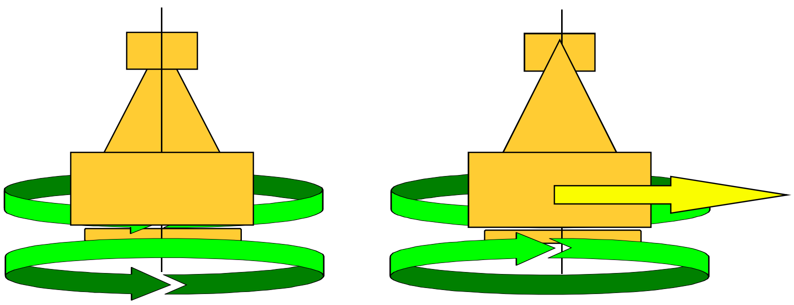
- Bowl assembled to cap nut and closing water added
- The force from the sliding bowl bottom via distributing cone is held by the cap nut
- The force on the cap nut alone is equal to 47 tons!



Safety - Energy of a bowl

Rotating energy

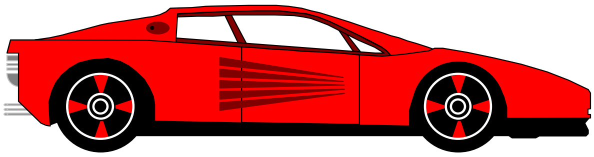
Same energy if bowl moves with speed



0,124 MNm	MMPX 403	84 m/s	or	303 km/h
1,05 MNm	FOPX 610	93 m/s	or	334 km/h

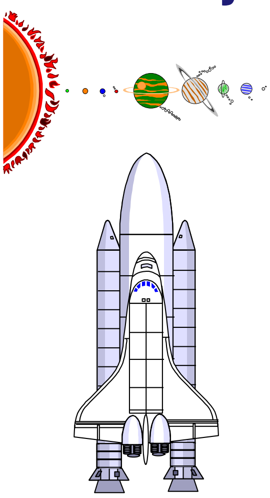
Energy of a bowl

The separator has the same kinetic energy as a motor car weighing 1000kg and moving

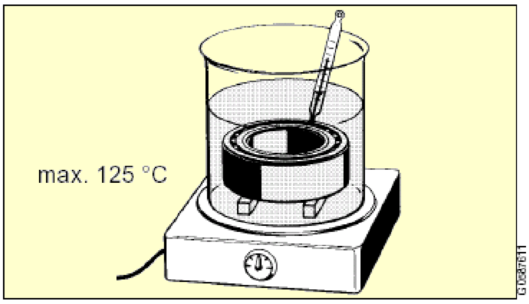


MMPX 403	**16 m/s**	**57 km/h**
FOPX 610	**46 m/s**	**165 km/h**

Safety - G force

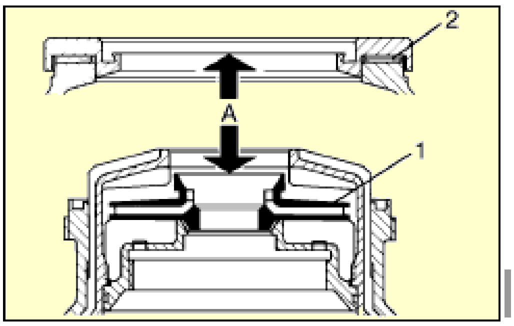


- One kg placed in the outer part of the sludge space of a bowl ”weighs”
- MMPX 403 10 tons
- FOPX 610 6 tons



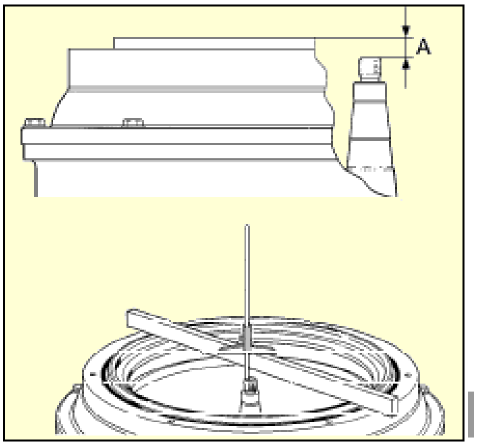
The bearing must not be in direct contact with the container

Oil paring disc height position



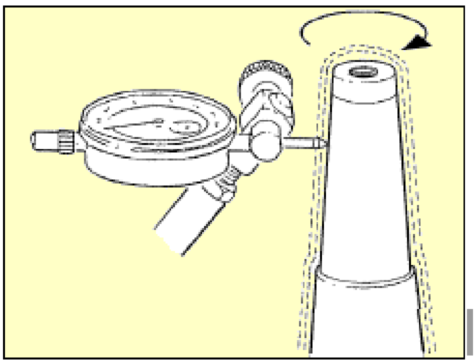
A= 65 ±0,5 mm

Bowl spindle height position



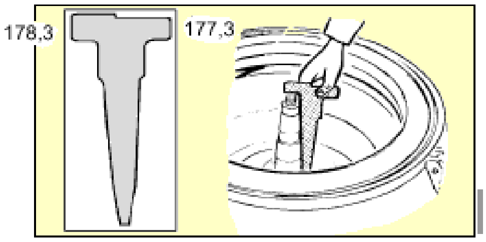
A = 24 ±1 mm

Bowl spindle radial wobble

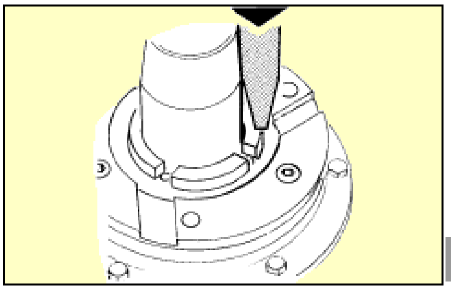


Max. radial wobble = 0,04 mm

Operating paring disc height position

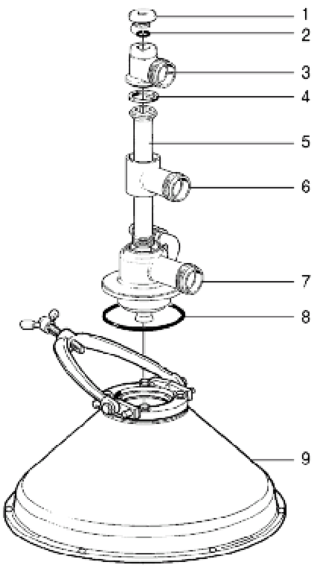


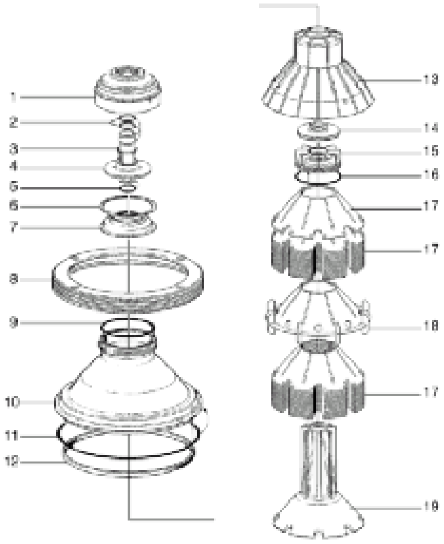
Templet supported on the spindle top



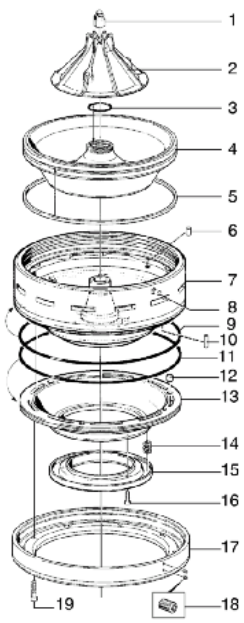
Templet supported on the operating paring disc

1. *Plug*
2. *O-ring*
3. *Support*
4. *Square-sectioned ring*
5. *Inlet pipe*
6. *Support*
7. *Connecting housing*
8. *O-ring*
9. *Frame hood*

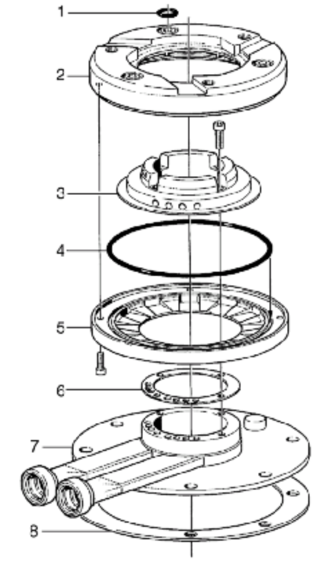




1. Paring chamber cover (small lock ring)
2. O-ring
3. O-ring
4. Upper paring disc
5. O-ring
6. Gasket
7. Flow control disc
8. Lock ring
9. O-ring
10. Bowl hood
11. O-ring
12. Seal ring
13. Top disc
14. Oil paring disc
15. Level ring
16. O-ring
17. Bowl disc
18. Wing insert
19. Distributor

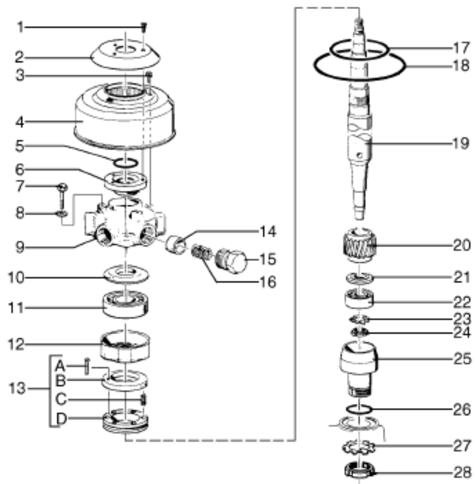


1. Cap nut
2. Distributing cone
3. O-ring
4. Sliding bowl bottom
5. Rectangular ring
6. Cylindrical pin
7. Bowl body
8. Guide lug
9. O-ring
10. Cylindrical pin
11. O-ring
12. Valve plug
13. Operating slide
14. Spring
15. Spring support
16. Screw
17. Dosing ring
18. Nozzle *)
19. Screw

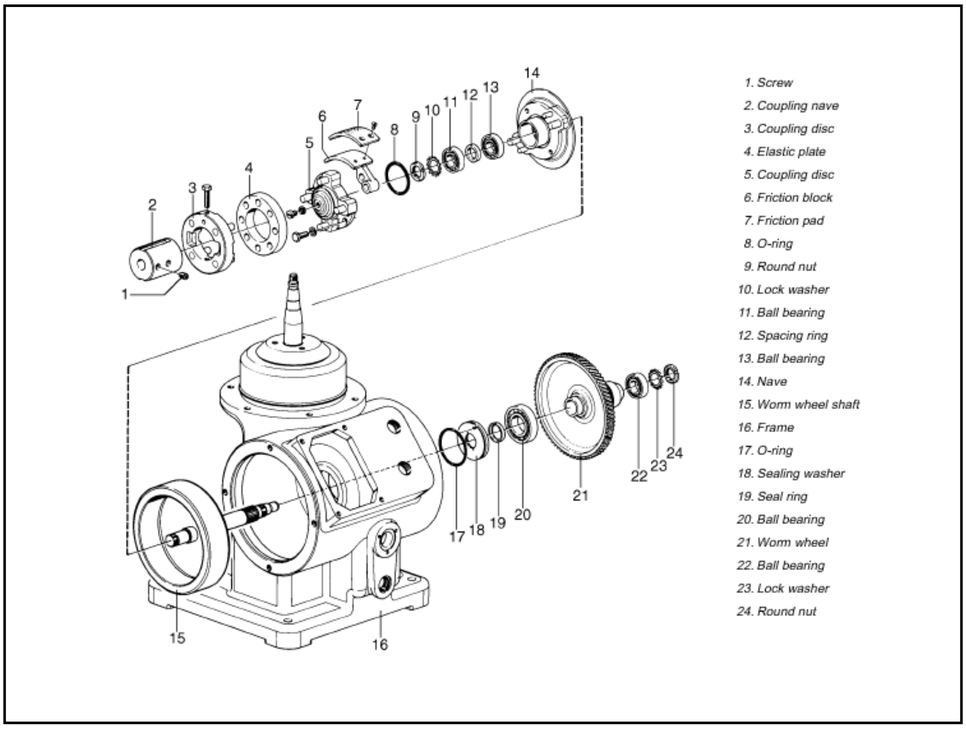


1. O-ring
2. Distributing ring
3. Control paring disc
4. O-ring
5. Cover
6. Gasket
7. Distributing cover
8. Height adjusting ring

1. Screw
2. Protecting plate
3. Screw
4. Protecting guard
5. O-ring
6. Protecting collar
7. Screw
8. Spring washer
9. Spring casing
10. Deflector
11. Ball bearing
12. Ball bearing housing
13. Axial buffer
    - 13A. Split pin
    - 13B. Wear ring
    - 13C. Spring
    - 13D. Spring support



14. Buffer
15. Screw plug
16. Spring
17. O-ring
18. O-ring
19. Bowl spindle
20. Worm
21. Spacing washer
22. Ball bearing
23. Lock washer
24. Round nut
25. Bushing
26. O-ring
27. Lock washer
28. Round nut


1. Screw
2. Coupling nave
3. Coupling disc
4. Elastic plate
5. Coupling disc
6. Friction block
7. Friction pad
8. O-ring
9. Round nut
10. Lock washer
11. Ball bearing
12. Spacing ring
13. Ball bearing
14. Nave
15. Worm wheel shaft
16. Frame
17. O-ring
18. Sealing washer
19. Seal ring
20. Ball bearing
21. Worm wheel
22. Ball bearing
23. Lock washer
24. Round nut


Separation Unit
Alfa Laval
Alfa Laval

Triple System Module.

SA – Separator Ancillaries

Minimal investment

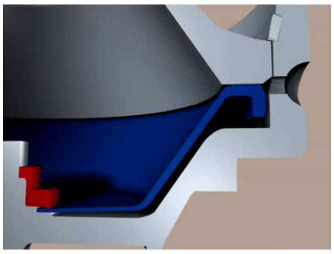
Specialized block components assembled on site

- Reduce your initial investment cost

CentriShoot

A fixed, flexing discharge slide replaces the sliding bowl bottom.

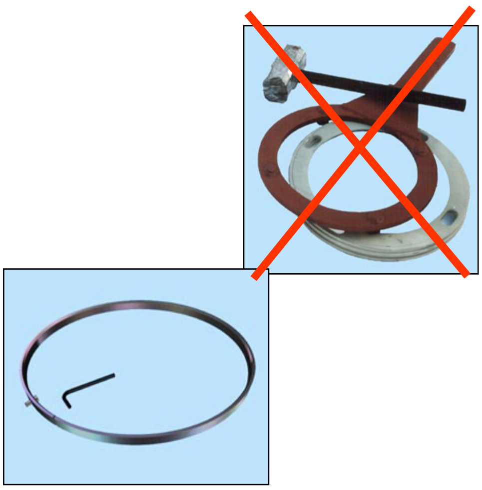
- No metal-to-metal wear
- No damage to the separator bowl



CentriLock™

CENTRILOCK™
NEW LOCK RING

- Easy to remove and open the bowl
- No need for heavy hammers
- No galling of threads
- Eliminates wear and tear
- No hydraulic compression tool needed

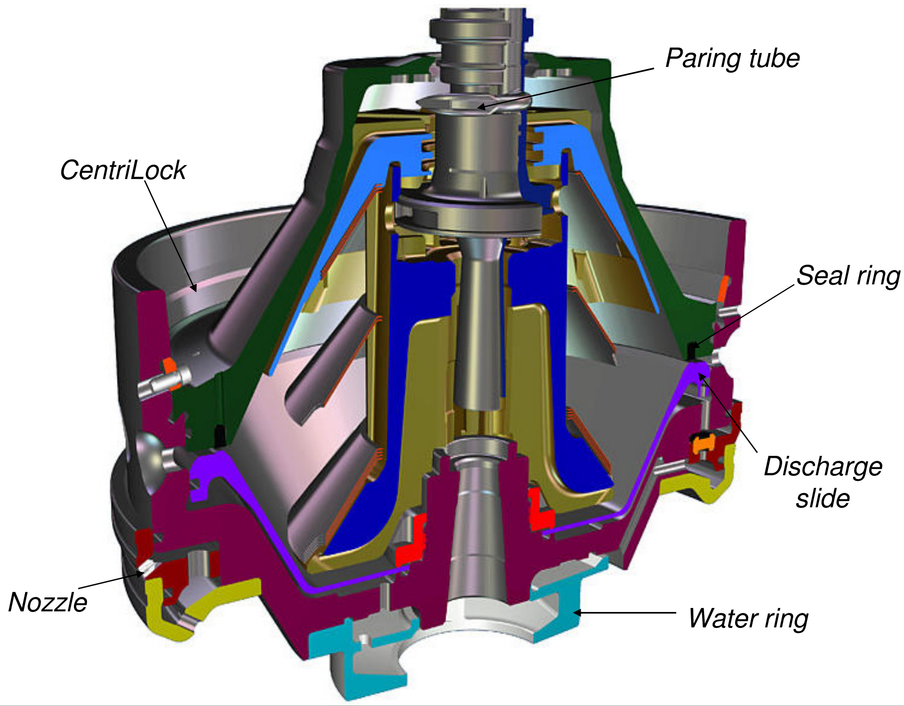


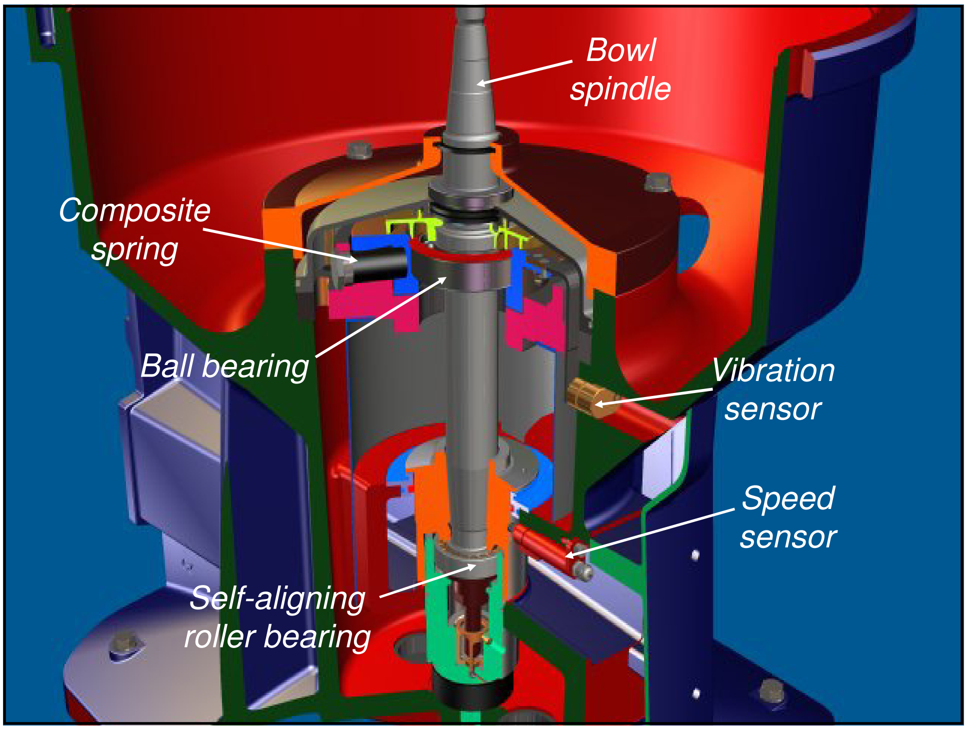
Long bowl life

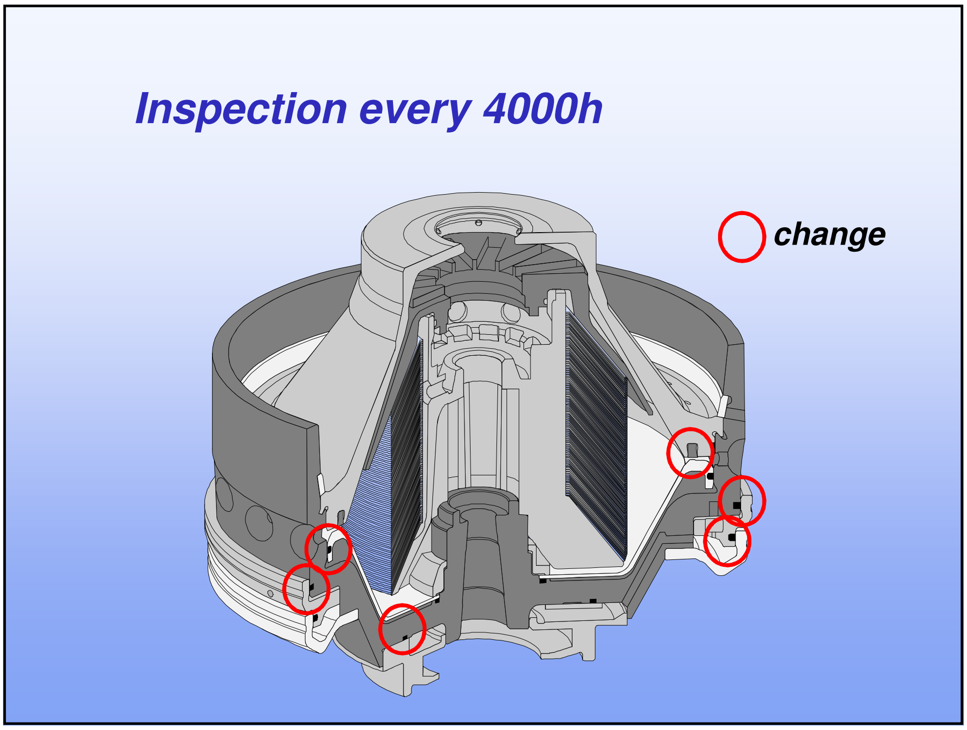
By eliminating wear, CentriShoot and CentriLock eliminate the need for bowl repair.

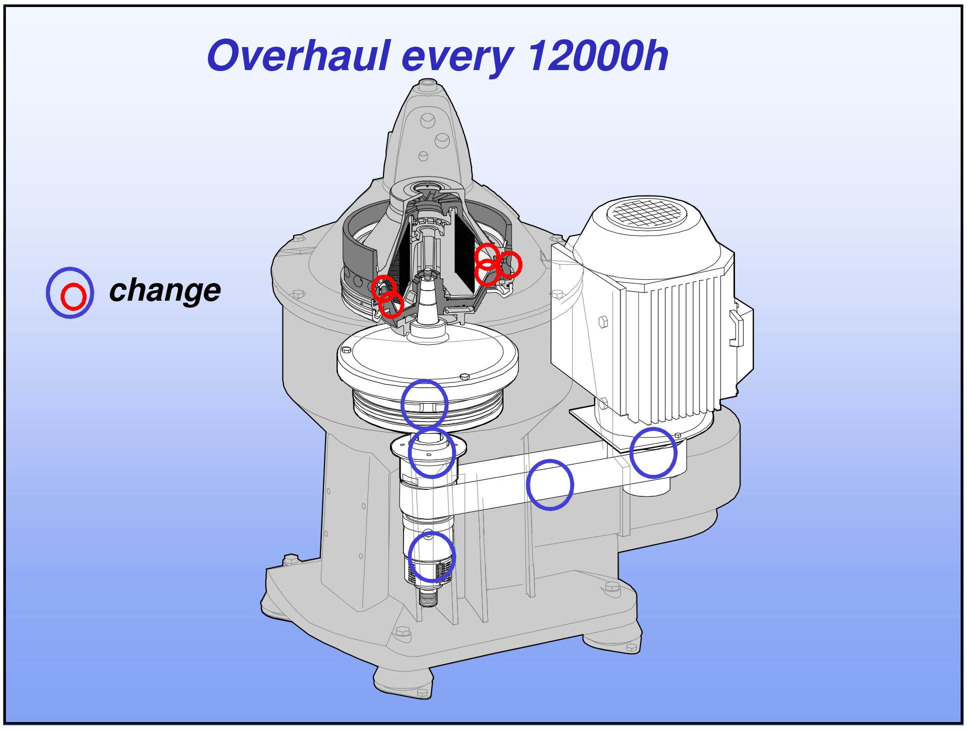
A life cycle savings of up to 50 000 USD!

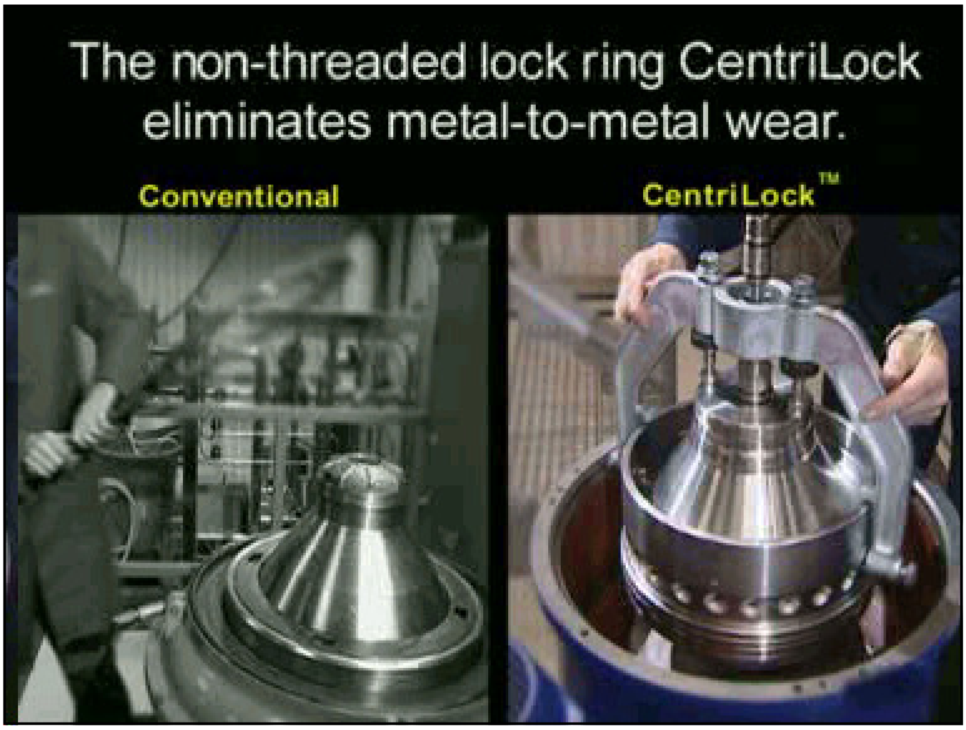
CentriShoot CentriLock

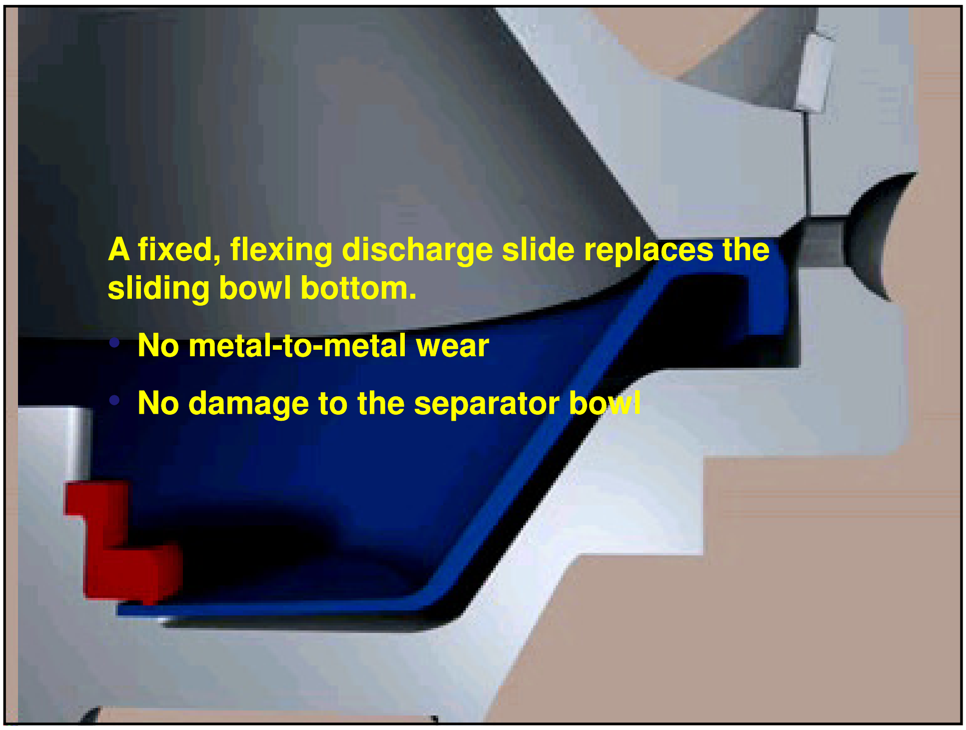


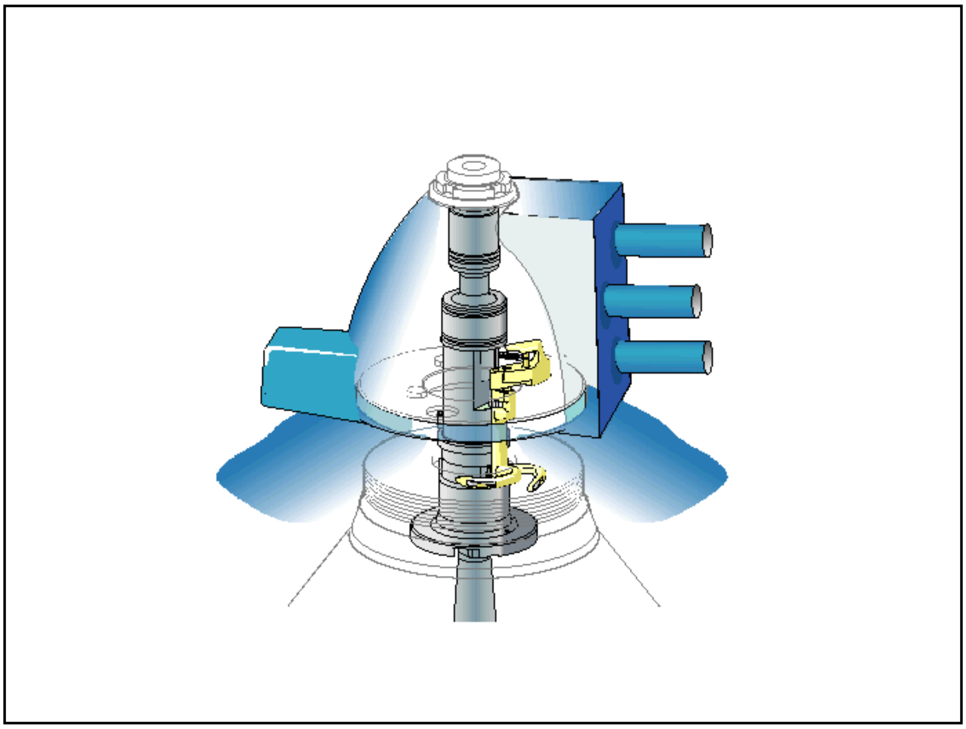

Bowl
spindle
Composite
spring
Ball bearing
Vibration
sensor
Speed
sensor
Self-aligning
roller bearing

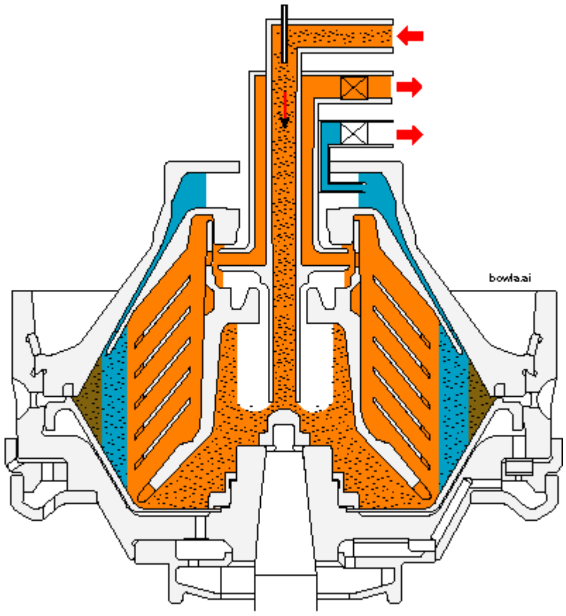

Inspection every 4000h
change

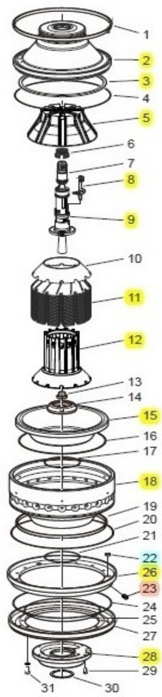

Overhaul every 12000h
change


The non-threaded lock ring CentriLock
eliminates metal-to-metal wear.
Conventional
CentriLock™


A fixed, flexing discharge slide replaces the sliding bowl bottom.
• No metal-to-metal wear
• No damage to the separator bowl

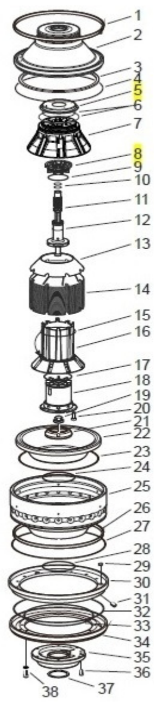






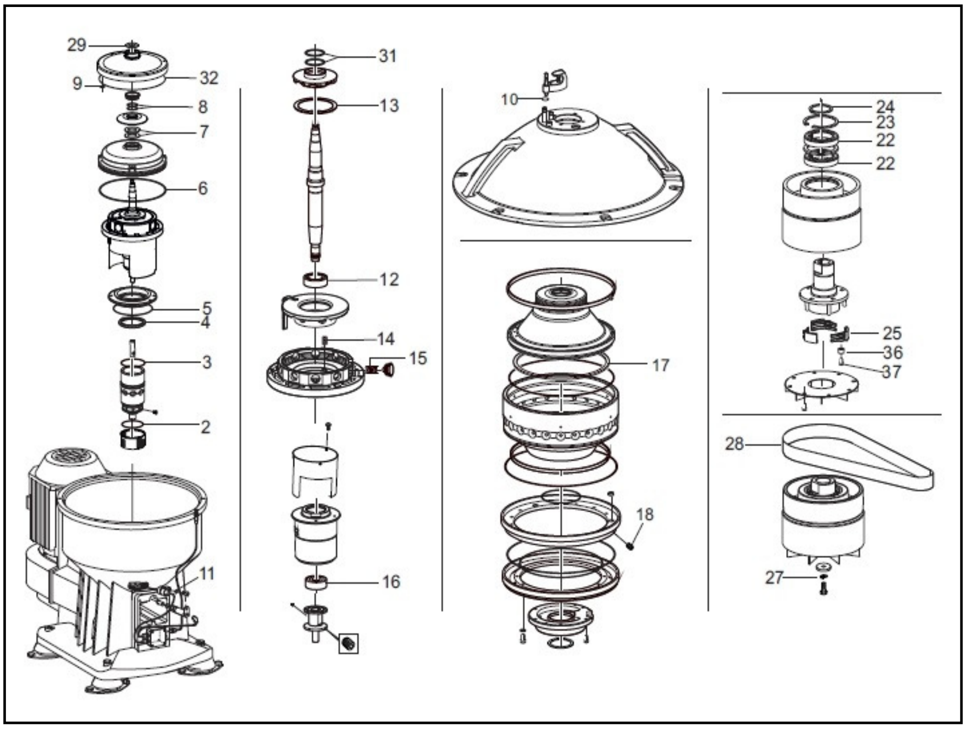
ALCAP

1. Lock ring
2. Bowl hood
3. Seal ring
4. O-ring
5. Top disc
6. O-rings
7. Inlet and outlet pipe
8. Paring tube
9. Splash sealing
10. Bowl disc (without caulks)
11. Bowl discs
11a. Bowl discs (smaller diameter)
12. Distributor
13. Cap nut
14. Nut
15. Discharge slide
16. Rectangular ring
17. O-ring
18. Bowl body
19. Guide ring
20. Rectangular ring
21. O-ring
22. Valve plugs
23. Nozzle
24. Rectangular ring
25. O-ring
26. Operating slide
27. Holder
28. Operating water ring
29. Screws
30. Seal ring
31. Screws & washers



PURIFIER

1. Lock ring
2. Bowl hood
3. Seal ring
4. O-ring
5. Gravity disc
6. O-rings
7. Top disc
8. Level ring
9. O-ring
10. O-rings
11. Inlet and outlet pipe
12. O-ring
13. Bowl disc (without caulks,
14. Bowl discs
15. O-ring
16. Distributor
17. O-ring
18. Distributor support
19. Cap nut
20. Screw
21. Nut
22. Discharge slide
23. Rectangular ring
24. O-ring
25. Bowl body
26. Guide ring
27. Rectangular ring
28. O-ring
29. Valve plugs
30. Operating slide
31. Nozzle
32. Rectangular ring
33. O-ring
34. Holder
35. Operating water ring
36. Screws
37. Seal ring
38. Screws & washers



ΒΙΒΛΙΟΓΡΑΦΙΑ

ΤΑ ΚΕΙΜΕΝΑ ΚΑΙ ΟΙ ΦΩΤΟΓΡΑΦΙΕΣ ΤΗΣ ΠΑΡΟΥΣΙΑΣΗΣ, ΕΧΟΥΝ ΑΝΤΙΓΡΑΦΕΙ:

- ΑΠΟ ΠΑΡΟΥΣΙΑΣΕΙΣ ΚΑΙ MANUALS ΤΗΣ ALFA LAVAL,
- ΑΠΟ ΔΙΑΦΟΡΕΣ ΙΣΤΟΣΕΛΙΔΕΣ ΤΟΥ ΔΙΑΔΥΚΤΙΟΥ,

T. Ballas